ESDU Catalogue 2023

Validated Engineering Design Methods

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About ESDU

ESDU has over 80 years of experience providing engineers with the information, data, and techniques needed to continually improve fundamental design and analysis.

ESDU provides validated engineering design data, methods, and software that form an important part of the design operation of companies large and small throughout the world. ESDU's wide range of industry-standard design tools are presented in over 1500 design guides with supporting software.

Guided and approved by independent international expert Committees, and endorsed by key professional institutions, ESDU methods are developed by industry for industry. ESDU's staff of engineers develops this valuable tool for a variety of industries, academia, and government institutions.

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ESDU Engineering Methods and Software

The ESDU Catalog summarizes more than 350 Sections of validated design and analysis data, methods and over 200 related computer programs.

ESDU Series, Sections, and Data Items

ESDU methods and information are categorized into Series, Sections, and Data Items. Data Items provide a complete solution to a specific engineering topic or problem, including supporting theory, references, worked examples, and predictive software (if applicable).

Collectively, Data Items form the foundation of ESDU. Data Items are prepared through ESDU's validation process which involves independent guidance from committees of international experts to ensure the integrity and information of the methods. Consequently, every Data Item is presented in a clear, concise, and unambiguous format, and undergoes periodic review to ensure accuracy.

Sections are comprised of groups of Data Items. Each section contains selected content to provide engineers with information relevant to a specific engineering subject area. Series are comprised of groups of Sections that provide extensive design information for a broad engineering area.

ESDU Software

ESDU produces computer programs that perform a specific engineering calculation associated with a specific Data Item. These programs are complete with full documentation, worked examples and sample input files. Some computer programs, called ESDUpacs, are written in strict ANSI 77 FORTRAN.

An ESDUpac is a computer program designed to perform a specific engineering calculation associated with a specific Data Item. ESDUpacs are provided in two forms.

ESDUpac online access

Other ESDUpacs are supplied as ZIP files containing PC specific executable codes (.exe files) and all associated data files. These codes have no user interface and are primarily file input/file output programs.

ESDU Support

In addition to receiving the world's most rigorously evaluated engineering information, technical support is available from ESDU's engineering staff. You can contact ESDU engineers via telephone or email, with any questions you may have. ESDU has over 80 years of experience in delivering engineering methods and information to help you gain maximum value from the Data Items and Software.

ESDU is supported from offices in the United Kingdom and the United States, as well as through dealers, agents, and sales representatives in over 80 countries. View contacts.

ESDU Availability

ESDU is available via the Internet 24/7, so your staff can access our methods and information from any Internet-connected computer. The ESDU web site, www.esdu.com, provides a free subject index to all ESDU Series, Sections, and Data Items.

Contents

Series Overviews

Aerodynamics

This Series includes a wide range of data and methods applicable to the project design of aircraft, guided weapons, space rockets, and more. The data covers general aerodynamics properties (including atmospheric conditions); airframe components and the effect of power plant/airframe interactions for propeller-powered and jet aircraft; the effect of surface imperfections on drag; the aerodynamics of controls, flaps and leading-edge devices; aircraft stability, the aerodynamics of internal flow systems, and more.

Asteroid

Aircraft Surface Tolerances for Enhanced Repair, Operations and Design.

Aircraft Noise

This Series provides validated data on the prediction, propagation, and suppression of noise. The series is applicable and relevant to industrial and traffic noise problems and health and safety issues, including the estimation of noise from specific sources such as jet exhausts, turbofans, propellers, and airframes.

Composites

This Series is a collection of data for use in the design of fibre-reinforced laminated composite materials. The Series contains solutions to strength analysis problems, such as failure criteria, plate vibration and buckling, analysis of bonded joints, and stress concentrations including built-in thermal stresses. Because laminated composites can be specified in very many forms and assembled in a multitude of lay-up arrangements, FORTRAN programs are provided for many of the analysis methods.

Dynamics

This Series covers the treatment of the behavior and motion of a system, and the resulting stability and controllability of that system, particularly under non-steady conditions where the dynamic nature of the system plays an important part in determining its behavior.
Part of the series is devoted solely to aircraft topics which include the equations of motion, conversion formulae for rotation and translation of body axes, geometric and kinematic relationships for various axis systems, direction and incidence angles and measures of damping.

Fatigue – Endurance

This Series includes methods and data for strength calculations on aircraft and aerospace structures, as well as general engineering. The data are principally used in the design of "safe-life design" when the structure or component is required to be crack-free for the specified design life. The major part of the data consists of constant amplitude stress-endurance curves (S-N curves) for aircraft materials (aluminium and titanium alloys and steels) and structural joints (riveted, bolted, or bonded).

Fatigue – Fracture Mechanics

This Series includes methods and data for strength calculations primarily on aircraft and aerospace structures, and relates to damage-tolerant design. The principles of linear elastic fracture mechanics are employed to provide data for strength analysis of cracked or flawed structures or components. The data are grouped according to material, aluminium or titanium alloys, or steels. In addition, an introduction to the principles of fracture mechanics is included with example calculations.

Fluid Mechanics, Internal Flow

This Series covers flow and pressure losses in pipe or duct networks, losses in components such as ends, valves, orifices, tube banks, and noise in ventilating systems. The data and methods determine accurate pressure losses in internal flow systems; predicting the performance of apparatus such as heat exchangers, fuel lines and engines; and selecting/testing proper equipment such as pumps and fans. The data is also important for safety reasons, such as in sizing safety.

Fluid Mechanics, Internal Flow (Aero)

This Series methods and data are for use by plant engineers, design engineers, or consultants in day-to-day evaluations of fluid flow through various piping systems. Hand calculation methods and computer programs based on empirically-derived correlations and numerical methods provide rapid and reliable estimates of fluid flow parameters. The limits of applicability are stated, and guidance is given on the maximum tolerance to be allowed on the predictions.

Heat Transfer

This Series includes methods and data for use by process plant engineers, design engineers, or consultants dealing with the evaluation or prediction of the performance of heat transfer equipment and the costing of heat exchangers. The Sections give step-by-step calculation methods and indicate the limits of applicability and accuracy of empirical correlations.

Mechanisms

This Series covers methods and data for the design and analysis of cams, gears, linkages and Geneva mechanisms, and also includes contact stress estimation. The data and methods are concerned with the motion, forces, and power transmission associated with the design and evaluation of the moving components of a machine. These components must be designed to produce the output motion required of them and operate within constraints of space and machine timing while maintaining satisfactory dynamic performance and operating life.

Performance

This Series provides data and methods both for the estimation of the performance of a proposed aircraft at every stage of its design, from project stage to operation, and for performance measurement, i.e. speeds, accelerations, range/endurance, take-off/landing, climb/descent, and maneuverability.

Physical Data, Chemical Engineering

This Series provides the most reliable correlated data available for the physical properties of a wide range of pure compounds, and some mixtures, used in the chemical industry. The data, which are provided as equations and in tabular form, are based on the most reliable experimental data, both reported and unreported.

The Physical Data, Chemical Engineering Series provides the following properties data.

- Vapour pressure
- Liquid density
- Liquid heat capacity and enthalpy
- Liquid viscosity
- Liquid and gas thermal conductivity
- Fire hazard properties
- Properties of water substance

Stress and Strength

This Series provides strength analysis of components used in general mechanical engineering. The information has been evaluated by engineers to ensure soundly based analysis leading to safe, cost-effective design is applied. The information is divided into three principal types:

- The design of commonly used components such as struts, beams, shafts, plates, pressure vessels, pipes, fastenings, welds and springs is considered, and design notes and methodology are covered
- Data for certain stress intensity factors and contact stresses are given
- Data are presented on the fatigue strength of materials, both as constant amplitude stress versus endurance (S-N) curves and in terms of linear elastic fracture mechanics. The fatigue data are for many low and high alloy and stainless steels made to US, UK and European specifications, and the fracture mechanics data include both crack propagation rates, and fracture toughness values

Structures

This Series contains information for the strength analysis of lightweight structures. Data is provided on elastic or inelastic stresses, strains, displacements or buckling loads under static loading. They range from general data, with application regardless of component form, to the analysis of specific components in metallic, compound (sandwich) or composite structures. Examples of specific components are beams, struts, panels, stress raisers (stress concentrations) and joints.

Transonic Aerodynamics

This Series is concerned with the flow around aerofoils, wings, bodies and cowls at high subsonic, transonic and (in a few cases) low supersonic speeds. The transition from high subsonic to transonic flow is marked by the development of a local region of supersonic flow embedded in the otherwise wholly subsonic flow and the consequent development of shock waves and shock wave drag.

Tribology

The Series provides methods and data for design, analysis, and selection of components associated with lubrication, and is composed of items on bearings, temperatures, contact stresses, lubrication, seals, and material selection. Tribology often is regarded as the meeting point of all mechanical engineering disciplines.

Vibration and Acoustic Fatigue

The Series provides simple and efficient methods for estimating the response and fatigue life of structures typical of those used in the aerospace industry, including fibre-reinforced composites, when subjected to acoustic loading. Although it is not possible to predict precisely the response of a structure under acoustic loading, the structural parameters of various designs can be compared and the design selected to give the best relative performance for a noisy environment. Information is provided on noise from the near-field of turbo-jet engines and from propeller-driven aircraft.

Wind Engineering

The Series provides reliable methods and data for predicting the loads on, and the response of, buildings and structures to the wind. In order to do this, the information includes methods and a computer program for estimating design wind speeds and turbulence properties for all types of terrain, including topographic effects on wind speed. Comprehensive prediction procedures are provided for estimating force and pressure coefficients for structures.

Aerodynamics

☐ Section 1: Organizational Documents

ESDU 00001

Aerodynamics Series: Record of Document.

ESDU CFA

Conversion factors.

☐ Section 2: Properties of Gases

ESDU AERO 00.01.06

Thermodynamic properties of air in dissociation equilibrium.

ESDU AERO 00.01.07

Approximate transport properties of high-temperature air in dissociation equilibrium.

ESDU AERO 00.01.08

Specific heat capacities and their ratio as functions of temperature for several common gases.

ESDU AERO 00.01.09

A simple model of a thermally perfect, calorically imperfect diatomic gas. Comparison with real gases.

ESDU AERO 00.01.11

Mollier chart of the thermodynamic properties of argon-free air in dissociation equilibrium: T = 2 000 K to T = 13 000 K.

ESDU AERO 00.01.12

Mollier chart of the thermodynamic properties of argon-free air in dissociation equilibrium: T = 100 K to T = 6 000 K.

ESDU AERO S.00.03.27

Examples in the use of the Mollier chart (isentropic flow and Prandtl-Meyer expansion for air in dissociation equilibrium).

☐ Section 3: Isentropic Flow and Shock Waves

ESDU AERO 00.03.05

Isentropic expansion of air from rest.

ESDU AERO S.00.03.06

Introductory sheet on isentropic flow and shock waves.

ESDU AERO S.00.03.08

Simple-wave flow.

ESDU AERO S.00.03.09

Properties of plane steady shock waves.

ESDU AERO S.00.03.14

Approximate calculation of the pressure changes in two-dimensional supersonic flow.

ESDU AERO S.00.03.15

Pitot and static tubes in supersonic flow.

ESDU AERO S.00.03.16

Conditions for shock wave detachment and for subsonic flow behind nose shock waves on cones at zero incidence and on wedges.

ESDU AERO S.00.03.22

Conditions behind normal shock waves in air in dissociation equilibrium.

ESDU AERO S.00.03.23

Conditions behind oblique shock waves for air in dissociation equilibrium.

ESDU AERO 00.03.28

Conditions behind normal shock waves in a perfect gas for various values of Y.

ESDU AERO 00.03.30

Solutions to the oblique shock wave relations for a range of specific heat ratios: pressure coefficient and detachment angle.

ESDU AERO 00.03.31

Solutions to the Prandtl-Meyer expansion relations for a range of specific heat ratios: pressure coefficient and maximum flow deflection angle.

ESDU 70008

Inviscid supersonic flow past cones at zero incidence: (i) shock angle.

ESDU AERO S.00.03.13

Inviscid supersonic flow past cones at zero incidence: (ii) surface pressure coefficient and shock angle for circular cones.

ESDU 70009

Inviscid supersonic flow past cones at zero incidence: (iii) flow deflection in the conical flow field.

☐ Section 4: Properties of the Atmosphere

ESDU 73017

Reynolds number, speed of sound, dynamic viscosity, kinetic pressure, and total pressure coefficient in air.

ESDU 77021

Properties of a standard atmosphere.

ESDU 78008

Physical properties of design atmospheres.

ESDU 78017

True airspeed in the International Standard Atmosphere and equivalent airspeed corresponding to Mach number and pressure altitude.

☐ Section 5: Atmospheric Turbulence

ESDU 74030

Characteristics of atmospheric turbulence near the ground. Part I: definitions and general information.

ESDU 85020

Characteristics of atmospheric turbulence near the ground. Part II: single point data for strong winds (neutral atmosphere).

ESDU 86010

Characteristics of atmospheric turbulence near the ground. Part III: variations in space and time for strong winds (neutral atmosphere).

☐ Section 6: Wind Speeds

ESDU 82026

Strong winds in the atmospheric boundary layer. Part 1: hourly-mean wind speeds.

ESDU 83045

Strong winds in the atmospheric boundary layer. Part 2: discrete gust speeds.

☐ Section 7: Aerofoils and Wings - General

ESDU 76003

Geometrical properties of cranked and straight-tapered wing planforms.

ESDU TM 168

ESDU TECHNICAL MEMORANDUM
Derivation of equations for the geometrical properties of straight-tapered and multi-panel wings.

ESDU 10023

Computer program for calculation of equivalent straight-tapered wing planform.

ESDU 06020

Computer program for estimation of aerofoil characteristics at subcritical speeds: lift-curve slope, zero-lift incidence and pitching moment, aerodynamic center and drag polar minimum.

ESDU TM 4

ESDU TECHNICAL MEMORANDUM
Correlations for some aerodynamic characteristics of aerofoils in incompressible inviscid flow.

☐ Section 8: Aerofoils at Subcritical Speeds - Pressure Distribution, Lift, Pitching Moment, Aerodynamic Centre

ESDU AERO W.01.01.05

Slope of lift curve for two-dimensional flow.

ESDU AERO W.01.01.07

Maximum lift coefficients for aerofoil sections at Mach numbers from 0.60 to 0.75.

ESDU AERO A.08.01.05

Aerodynamic center in two-dimensional flow.

ESDU 66034

The low-speed stalling characteristics of aerodynamically smooth aerofoils.

ESDU 71020

Aerofoils having a specified form of upper-surface pressure distribution: details and comments on design.

ESDU 72024

Aerodynamic characteristics of aerofoils in compressible inviscid airflow at subcritical Mach numbers.

ESDU 84026

Aerofoil maximum lift coefficient for Mach numbers up to 0.4.

ESDU 97020

Slope of aerofoil lift curve for subsonic two-dimensional flow.

ESDU 98011

☐ Section 9: Aerofoils at Subcritical Speeds - Drag

ESDU AERO W.02.04.00

Information on the use of Data Items in the series Wings 02.04.

ESDU AERO W.02.04.01

Drag of a smooth flat plate at zero incidence.

ESDU AERO W.02.04.02

Profile drag of smooth wings.

ESDU AERO W.02.04.03

Profile drag of smooth aerofoils with straight trailing- edges at low speeds.

ESDU AERO W.02.04.09

Limit of grain size for laminar flow over wings or bodies.

ESDU AERO W.02.04.11

Limit of surface waviness for laminar flow over wings.

ESDU 67011

Profile drag at the drag-rise condition of aerofoils having a specified form of upper-surface pressure distribution at this condition.

ESDU 00027

Aerofoil profile drag for Mach numbers below the drag rise condition.

ESDU 06001

Aerofoil skin friction drag for Mach numbers below the drag-rise condition.

ESDU 10017

A guide to the alleviation of the base drag of a two-dimensional flat plate with a blunt trailing edge.

☐ Section 10: Aerofoils at Supersonic Speeds - Pressure Distribution, Lift, Pitching Moment, Drag

ESDU AERO W.S.00.03.03

Introductory Item on two-dimensional aerofoils at supersonic speeds.

ESDU AERO W.S.00.03.04

Theoretical properties of two-dimensional supersonic aerofoils of simple section.

ESDU AERO W.S.00.03.05

The calculation of the theoretical characteristics of two-dimensional aerofoils at supersonic speeds.

ESDU AERO W.S.02.03.07

Base pressure on aerofoil sections with a blunt trailing edge in supersonic flow.

ESDU AERO W.S.02.03.10

Wave drag of flat plates with blunt noses at zero incidence.

ESDU AERO W.S.02.04.12

Skin friction drag coefficients for a flat plate in two-dimensional flow with zero heat transfer.

ESDU AERO W.S.02.04.13

Profile drag coefficients for two-dimensional biconvex aerofoil with zero heat transfer at supersonic speeds.

ESDU AERO W.S.05.03.01

Pressure distribution on blunt noses of two-dimensional sections at zero incidence in supersonic flow.

☐ Section 11: Critical Mach Number and Pressure Coefficient

ESDU 74008

Estimation of critical Mach number for an aerofoil from its low-speed pressure distribution.

ESDU 75027

Critical pressure coefficient and component of local Mach number normal to the surface isobar for a swept wing.

ESDU AERO W.00.03.01

Critical Mach number for high speed aerofoil sections.

☐ Section 12: Flat Plates - Boundary Layers, Skin Friction and Surface Roughness

ESDU 68019

The compressible two-dimensional laminar boundary layer, both with and without heat transfer, on a smooth flat plate, with application to wedges, cylinders, and cones.

ESDU 68020

The compressible two-dimensional turbulent boundary layer, both with and without heat transfer, on a smooth flat plate, with application to wedges, cylinders, and cones.

ESDU 73016

The mean skin friction coefficient for a rough flat plate with a turbulent two-dimensional boundary layer in compressible adiabatic flow, with application to wedges, cylinders and cones.

☐ Section 13: Wings - Lift, Pitching Moment, Aerodynamic Centre, Spanwise Loading

ESDU 70011

Lift-curve slope and aerodynamic center position of wings in inviscid subsonic flow.

ESDU TM 169

ESDU TECHNICAL MEMORANDUM
Wing lift-curve slope in inviscid subsonic flow: Improvements to the Helmbold-Diederich equation and comparison with data from ESDU 70011.

ESDU 70012

Lift-curve slope and aerodynamic center position of wings in inviscid supersonic flow.

ESDU 70015

Fluid forces and moments on flat plates.

ESDU 71006

Low-speed longitudinal aerodynamic characteristics of slender wings.

ESDU 71007

Low-speed normal force and pitching moment of slender wings in ground effect.

ESDU 83040

Method for the rapid estimation of span wise loading of wings with camber and twist in subsonic attached flow.

ESDU 87001

Wing pitching moment at zero lift at subcritical Mach numbers.

ESDU 87031

Wing angle of attack for zero lift at subcritical Mach numbers.

ESDU 88030

Boundaries of linear characteristics of cambered and twisted wings at subcritical Mach numbers.

ESDU 89034

The maximum lift coefficient of plain wings at subsonic speeds.

ESDU 90013

Normal force and pitching moment of low aspect ratio cropped-delta wings up to high angles of attack at supersonic speeds.

ESDU 93015

Program for calculation of maximum lift coefficient of plain aerofoils and wings at subsonic speeds.

ESDU 93034

Normal force of low-aspect-ratio cropped-delta wings up to high angles of attack at subsonic speeds.

ESDU 95010

Computer program for estimation of span wise loading of wings with camber and twist in subsonic attached flow. Lifting-surface theory. (With Appendix A: effect of plain flaps).

ESDU 95022

Pitching moment of low-aspect-ratio cropped-delta wings up to high angles of attack at subsonic speeds.

ESDU AERO W.01.01.01

Lift-curve slope of swept and tapered wings.

ESDU AERO W.01.01.04

Effect of cut-out on lift-curve slope.

☐ Section 14: Wings - Drag

ESDU 66031

Introductory sheet on subcritical lift-dependent drag of wings.

ESDU 66032

Subsonic lift-dependent drag due to boundary layer of plane, symmetrical section wings.

ESDU 74035

Subsonic lift-dependent drag due to the trailing vortex wake for wings without camber or twist.

ESDU 75004

Wave drag of wings at zero lift in inviscid airflow.

ESDU 94037

Leading-edge suction distribution for plane thin wings at subsonic speeds.

ESDU 94038

Computer program for estimation of leading-edge suction distribution for plane thin wings at subsonic speeds.

ESDU 95025

Drag due to lift for plane swept wings, alone or in combination with a body, up to high angles of attack at subsonic speeds.

ESDU 96025

Drag due to lift for non-planar swept wings up to high angles of attack at subsonic speeds.

ESDU 07002

Wing viscous drag coefficient in shock-free attached flow.

ESDU 07003

Modelling of wing viscous drag coefficient in shock-free attached flow.

ESDU 10022

Trailing-vortex drag coefficient in shock-free attached flow - cambered and twisted wings

ESDU AERO W.S.02.03.02

Theoretical lift-dependent drag of wings at supersonic speeds.

ESDU AERO W.S.02.03.09

Transonic drag rise of rectangular symmetrical section wings at zero lift. NACA 65 series sections.

☐ Section 15: Bodies - General

ESDU 77028

Geometrical characteristics of typical bodies.

ESDU 78037

The influence of body geometry and flow conditions on axisymmetric velocity distributions at subcritical Mach numbers.

ESDU 79020

The influence of body geometry and flow conditions on axisymmetric boundary layers at subcritical Mach numbers.

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ESDU AERO B.S.02.03.01

Introductory notes on the drag at zero incidence of bodies at supersonic speeds.

ESDU AERO B.S.02.03.02

External wave drag at zero incidence in inviscid flow of simple ducted forebodies and truncated afterbodies.

ESDU AERO B.S.02.03.08

Forebody-afterbody interference wave drag of simple pointed or ducted body shapes with short midbodies.

ESDU AERO B.S.02.03.12

Supersonic base pressure of cylindrical bodies.

ESDU 68021

Foredrag of spherically-blunted conical forebodies at zero incidence in supersonic flow for Mach numbers up to 5.

ESDU 76033

Subsonic base drag of cylindrical bodies with conical boat-tails.

ESDU 77020

Subsonic pressure drag of conical boat-tails.

ESDU 78019

Profile drag of axisymmetric bodies at zero incidence for subcritical Mach numbers.

ESDU 78041

Transonic base and boat-tail pressure drag of cylindrical bodies with conical boat-tails.

ESDU 79022

Supersonic base drag of cylindrical bodies with conical boat-tails.

ESDU 80006

Drag increment due to rear fuselage upsweep.

ESDU 80021

Pressure drag of blunt forebodies at zero incidence for Mach numbers up to 10.

ESDU 82028

Pressure drag of spherically-blunted conical forebodies at zero incidence for Mach numbers of 3 and above.

ESDU 96012

Subsonic and transonic base and boat-tail pressure drag of cylindrical bodies with circular-arc boat-tails.

ESDU 96033

Effect of angle of attack on the base axial force and drag of cylindrical bodies with conical boat-tails.

ESDU 97022

Effect of stabilizing fins on base drag of cylindrical bodies at supersonic speeds.

ESDU 99010

Supersonic base drag of cylindrical bodies with a central propulsive jet.

ESDU 00017

Supersonic base and boat-tail pressure drag of cylindrical bodies with a conical boat-tail and a central propulsive jet.

ESDU 00026

Supersonic pressure drag of conical, circular-arc and parabolic boat-tails.

ESDU 01012

Subsonic pressure drag of boat-tails with negligible annular base area in the presence of a central propulsive jet.

ESDU 02012

Subsonic base and boat-tail pressure drag of cylindrical bodies with circular-arc boat-tails and a central propulsive jet.

☐ Section 17: Bodies - Pressure Distribution, Normal Force, Pitching Moment, Centre of Pressure

ESDU 82018

The pressure distribution at zero incidence over selected families of blunt axisymmetric forebodies.

ESDU 87033

Normal force and pitching moment of conical boat-tails.

ESDU 89008

Normal-force-curve and pitching-moment-curve slopes of forebody-cylinder combinations at zero angle of attack for Mach numbers up to 5.

ESDU 89014

Normal force, pitching moment and side force of forebody-cylinder combinations for angles of attack up to 90 degrees and Mach numbers up to 5.

ESDU 90034

Computer program for the calculation of normal force and pitching moment of forebody-cylinder combinations at angles of attack up to 90 degrees and Mach numbers up to 5, including the effects of conical boat-tailing.

ESDU 00028

Supersonic pressure and Mach number distributions over conical, circular-arc and parabolic boat-tails.

ESDU 04007

Normal force and pitching moment of non-axisymmetrical bodies: square and triangular cross-sections without corner rounding.

ESDU 05015

Normal force and pitching moment of non-circular bodies: elliptical cross-sections at supersonic speeds.

ESDU 07005

Normal force and pitching moment of non-axisymmetric bodies: square cross-sections with corner rounding.

ESDU AERO B.S.05.03.01

Pressure distribution on forebodies and afterbodies of revolution at zero incidence in inviscid flow.

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ESDU 13009

Computer program for calculation of aerodynamic center of wing-fuselage-nacelle combinations.

ESDU 76015

Aerodynamic center of wing-fuselage combinations.

ESDU 77012

Aerodynamic center of wing-fuselage-nacelle combinations: effect of wing-pylon mounted nacelles

ESDU 78013

Aerodynamic center of wing-fuselage-nacelle combinations: effect of rear-fuselage pylon-mounted nacelles.

ESDU 89042

Body effect on wing angle of attack and pitching moment at zero lift at low speeds.

ESDU 90020

Airframe-induced upwash at subsonic speeds.

ESDU 91007

Lift-curve slope of wing-body combinations.

ESDU 91042

Normal force of low aspect ratio wing-body combinations up to high angles of attack at supersonic speeds.

ESDU 92024

Aerodynamic center of wing-body combinations.

ESDU 92043

Pitching moment of low aspect ratio wing-body combinations up to high angles of attack at supersonic speeds.

ESDU 95009

Effect of wing height on lift and aerodynamic center for a slender wing-body combination.

☐ Section 19: Wing-Body Combinations - Drag ESDU AERO A.S.02.03.01

Explanatory notes on transonic and supersonic area rules.

ESDU AERO A.02.03.02

Optimum area distribution and associated theoretical transonic drag-rise for aircraft at zero lift.

☐ Section 20: Controls - Lift, Pitching Moment, Rolling Moment, Drag

ESDU AERO C.01.01.03

Rate of change of lift coefficient with control deflection in incompressible two-dimensional flow, (a2)0.

ESDU AERO C.01.01.04

Effect of gap on the slope of lift curve and slope of lift increment curve due to control surface deflection.

ESDU AERO C.08.01.01

Rate of change of pitching moment coefficient with control deflection for a plain control in incompressible two-dimensional flow, m0.

ESDU 74011

Rate of change of lift coefficient with control deflection for full-span plain controls.

ESDU 74012

Conversion of lift coefficient increment due to flaps from full span to part span.

ESDU TM 172

Derivation of part span factors for lift and rolling moment.

ESDU 76026

Lift and drag due to spoiler operation in the ground run.

ESDU 87008

Rudder sideforce, yawing moment and rolling moment control derivatives at low speeds: Y, N and L.

ESDU 88013

Rolling moment derivative, L for plain ailerons at subsonic speeds.

ESDU 88029

Yawing moment coefficient for plain ailerons at subsonic speeds.

ESDU 88040

Program for the calculation of aileron rolling moment and yawing moment coefficients at subsonic speeds.

ESDU 14004

Lift and rolling moment due to spoilers on wings at subsonic speeds with trailing-edge flaps undeployed.

ESDU 14005

Lift and rolling moment due to spoilers on wings at subsonic speeds with trailing-edge flaps deployed.

ESDU 96026

Drag and yawing moment due to spoilers.

ESDU 21005

Summary of Data Items on Controls.

☐ Section 21: Controls - Hinge Moment

ESDU AERO C.04.01.00

Introduction to Data Items on control hinge moments.

ESDU AERO C.04.01.01

Rate of change of hinge-moment coefficient with incidence for a plain control in incompressible two-dimensional flow, (b1)0.

ESDU AERO C.04.01.02

Rate of change of hinge-moment coefficient with control deflection for a plain control in incompressible two-dimensional flow, (b2)0.

ESDU AERO C.04.01.03

Effect of nose balance on two-dimensional control hinge-moment coefficients.

ESDU AERO C.04.01.04

Effect of Irving internal balance on hinge-moment coefficient in two-dimensional flow.

ESDU AERO C.04.01.06

Full-span control hinge-moment coefficient derivatives for unswept wings in incompressible flow with allowance for span wise variation of sectional properties.

ESDU AERO C.04.01.08

Control hinge-moment coefficient derivative due to tab.

ESDU 88003

Effect of unshielded and shielded horn balances on hinge moment coefficients for controls at low speeds.

ESDU 89009

Hinge moment coefficient derivatives for trailing-edge controls on wings at subsonic speeds.

ESDU 89010

Example of procedure in calculation of control hinge moments.

☐ Section 22: Flaps - General

ESDU 97002

Information for the use of Data Items on high-lift devices.

ESDU 97003

Fuselage interference effects on flap characteristics.

☐ Section 23: Flaps - Lift: Aerofoils

ESDU 94026

Introduction to the estimation of the lift coefficients at zero angle of attack and at maximum lift for aerofoils with high-lift devices at low speeds.

ESDU 94027

Increments in aerofoil lift coefficient at zero angle of attack and in maximum lift coefficient due to deployment of various leading-edge high-lift devices at low speeds.

ESDU 94028

Increments in aerofoil lift coefficient at zero angle of attack and in maximum lift coefficient due to deployment of a plain trailing-edge flap, with or without a leading-edge high-lift device, at low speeds.

ESDU 94029

Increments in aerofoil lift coefficient at zero angle of attack and in maximum lift coefficient due to deployment of a trailing-edge split flap, with or without a leading-edge high-lift device, at low speeds.

ESDU 94030

Increments in aerofoil lift coefficient at zero angle of attack and in maximum lift coefficient due to deployment of a single-slotted trailing-edge flap, with or without a leading-edge high-lift device, at low speeds.

ESDU 94031

Increments in aerofoil lift coefficient at zero angle of attack and in maximum lift coefficient due to deployment of a double-slotted or triple-slotted trailing-edge flap, with or without a leading-edge high-lift device, at low speeds.

ESDU AERO F.05.01.01

Normal force on flaps and controls.

☐ Section 24: Flaps - Lift: Wings

ESDU 74009

Lift coefficient increment at low speeds due to full-span split flaps.

ESDU 91014

Maximum lift of wings with trailing-edge flaps at low speeds.

ESDU 92031

Maximum lift of wings with leading-edge devices and trailing-edge flaps deployed.

ESDU 93019

Wing lift increment at zero angle of attack due to deployment of single-slotted flaps at low speeds.

ESDU 95021

Wing lift coefficient increment at zero angle of attack due to deployment of double-slotted or triple-slotted flaps at low speeds.

ESDU 96032

Wing lift coefficient increment at zero angle of attack due to deployment of leading-edge devices at low speeds.

ESDU 97009

Wing lift coefficient increment at zero angle of attack due to deployment of trailing-edge split flaps at low speeds.

ESDU 97011

Wing lift coefficient increment at zero angle of attack due to deployment of plain trailing-edge flaps at low speeds.

ESDU AERO F.01.01.08

Lift coefficient increment due to full-span slotted flaps.

ESDU AERO F.01.01.09

Lift coefficient increment due to full-span double flap (main flap slotted).

☐ Section 25: Flaps - Lift Curve

ESDU 96003

Lift curve of wings with high-lift devices deployed at low speeds.

ESDU 99031

Computer program for estimation of lift curve to maximum lift for wing-fuselage combinations with high-lift devices at low speeds.

☐ Section 26: Flaps - Pitching Moment

ESDU 98009

Aerofoil and wing pitching moment coefficient at zero angle of attack due to deployment of trailing-edge split flaps at low speeds.

ESDU 98017

Aerofoil and wing pitching moment coefficient at zero angle of attack due to deployment of trailing-edge plain flaps at low speeds.

ESDU 99004

Aerofoil and wing pitching moment coefficient at zero angle of attack due to deployment of trailing-edge single-slotted flaps at low speeds.

ESDU 99014

Aerofoil and wing pitching moment coefficient at zero angle of attack due to deployment of trailing-edge double-slotted and triple-slotted flaps at low speeds.

ESDU 00029

Aerofoil and wing pitching moment coefficient at zero angle of attack due to deployment of leading-edge high-lift devices.

ESDU 01013

Aerofoil and wing pitching moment coefficient increment at zero angle of attack due to deployment of leading-edge and trailing-edge high-lift devices in combination at low speeds.

ESDU 03017

Pitching moment curve of wings with leading-edge and trailing-edge high-lift devices deployed at low speeds.

ESDU AERO F.08.01.01

Pitching moment coefficient increment due to flaps for unswept wings.

ESDU AERO F.08.01.02

Increment to Cm 0 due to flaps on swept-back wings.

ESDU TM 200

Estimation of nacelle and flap effects on low-speed aerodynamic centre and zero-lift pitching moment of transport aircraft (tail-off).

☐ Section 27: Flaps - Drag

ESDU AERO F.02.01.06

Profile drag coefficient increment due to full-span single-slotted flaps (Handley Page and NACA types).

ESDU AERO F.02.01.07

Conversion factor for profile drag increment for part-span flaps.

ESDU AERO F.02.01.08

Vortex drag coefficient of wing with part-span flap and central cut-out.

ESDU 74010

Low-speed drag coefficient increment at zero lift due to full-span split flaps.

ESDU 87005

Increment in aerofoil profile drag coefficient due to the deployment of a single-slotted flap.

ESDU 87024

Low-speed drag coefficient increment at constant lift due to full-span plain flaps.

ESDU 01007

Trailing vortex drag factors for wings with part-span trailing-edge plain flaps.

ESDU 06014

Zero-lift drag coefficient increment due to full-span plain flaps.

ESDU 08013

Increment in wing profile drag coefficient due to the deployment of a single-slotted flap.

☐ Section 28: Excrescence Drag

ESDU 90029

An introduction to aircraft excrescence drag.

ESDU 71018

Approximate wave drag of rectangular planform fairings at zero incidence in supersonic flow.

ESDU 75028

Drag due to grooves in a flat plate with a turbulent boundary layer, at subsonic and supersonic speeds.

ESDU 75031

Drag of two-dimensional steps and ridges immersed in a turbulent boundary layer for Mach numbers up to 3.

ESDU 76008

Drag of transverse rows of spherically-headed rivets immersed in a turbulent boundary layer at subsonic and supersonic speeds.

ESDU 83025

Drag of circular cylinders normal to a flat plate with a turbulent boundary layer for Mach numbers up to 3.

ESDU 84035

Drag of stub wings and fairings on a flat plate with a turbulent boundary layer at subsonic and supersonic speeds.

ESDU 91028

Simplified method for the prediction of aerofoil excrescence drag magnification factor for turbulent boundary layers at subcritical Mach numbers.

ESDU 91029

Excrescence drag magnification factors at the drag-rise condition for aerofoils with a specified form of upper-surface pressure distribution.

ESDU 92039

Drag due to gaps round undeflected trailing-edge controls and flaps at subsonic speeds.

ESDU 93032

Examples of excrescence drag prediction for typical wing components of a subsonic transport aircraft at the cruise condition.

ESDU 16005

Mass flow rate of a leak into an external stream.

ESDU 16006

Drag due to a leak discharging into an external stream.

ESDU 18005

Mass flow rate of a leak into a plenum from an external stream.

ESDU 18006

Drag due to a leak into a plenum from an external stream.

☐ Section 29: Cavity Drag

ESDU 74036

Drag due to a circular cavity in a plate with a turbulent boundary layer at subsonic, transonic and supersonic speeds.

ESDU 00006

Drag of rectangular planform cavity in a flat plate with a turbulent boundary layer for Mach numbers up to 3. Part I: Closed flow.

ESDU 00007

Drag of a rectangular planform cavity in a flat plate with a turbulent boundary layer for Mach numbers up to 3. Part II: Open and transitional flows.

ESDU 10016

Drag of a rectangular planform cavity in a flat plate with a turbulent boundary layer for Mach numbers up to 3. Part III: Effect of doors.

ESDU 16007

Computer program for the estimation of the drag of a rectangular planform cavity, with or without doors, in a flat plate with a turbulent boundary layer for Mach numbers up to 3

☐ Section 30: Undercarriage Drag

ESDU 79015

Undercarriage drag prediction methods.

☐ Section 31: Canopy Drag

ESDU 67041

Drag of fighter-type canopies at subcritical Mach numbers.

☐ Section 32: Cavity Aerodynamics and Aero-Acoustics

ESDU 02008

Aerodynamics and aero-acoustics of rectangular planform cavities. Part I: Time-averaged flow.

ESDU 04023

Aerodynamics and aero-acoustics of rectangular planform cavities. Part II: Unsteady flow and aero-acoustics.

ESDU 16004

Aerodynamics and aero-acoustics of rectangular planform cavities. Part V: Bibliography (up to 2016).

☐ Section 33: Cavity Adverse Unsteady Flow Alleviation

ESDU 08011

Aerodynamics and aero-acoustics of rectangular planform cavities. Part IIIA: Alleviation of unsteady flow effects - Introduction.

ESDU 08012

Aerodynamics and aero-acoustics of rectangular planform cavities. Part IIIB: Alleviation of unsteady flow effects - acoustic suppression using passive devices.

ESDU 09001

Aerodynamics and aero-acoustics of rectangular planform cavities. Part IIIC: Alleviation of unsteady flow effects – acoustic suppression using active devices.

ESDU 09002

Aerodynamics and aero-acoustics of rectangular planform cavities. Part IIID: Alleviation of unsteady flow effects – Store deployment.

☐ Section 34: Internal Flow Systems - Ducts

ESDU AERO S.00.01.10

One-dimensional isentropic flow of a thermally perfect, calorically imperfect diatomic gas.

ESDU AERO S.00.03.07

One-dimensional isentropic gas flow.

ESDU 81004

Mass flow and momentum functions for one-dimensional flow of gas in ducts.

☐ Section 35: Internal Flow Systems - Nacelles, Intakes and Nozzles

ESDU AERO A.08.01.09

Flow field of subsonic axisymmetric jet in a parallel stream.

ESDU 66028

Relationships between some common intake parameters.

ESDU 67035

Jet flow parameters.

ESDU 75005

Performance data for the critical operation of nominally two-dimensional double-ramp supersonic intakes. **ESDU 80037**

Pressure recovery of axisymmetric intakes at subsonic speeds.

ESDU 81024

Drag of axisymmetric cowls at zero incidence for subsonic Mach numbers.

ESDU 86002

Drag and pressure recovery characteristics of auxiliary air inlets at subsonic speeds.

ESDU 03006

Subsonic drag and pressure recovery of rectangular planform flush auxiliary inlets with ducts at angles up to 90 degrees.

☐ Section 36: Powerplant/Airframe Interactions - Propeller Powered Aircraft

ESDU 85015

Introduction to installation effects on thrust and drag for propeller-driven aircraft.

ESDU 85017

Thrust and drag accounting for propeller/airframe interaction.

ESDU 86017

Propeller/body interaction for thrust and drag.

ESDU 88031

Lift and longitudinal forces on propeller/nacelle/wing/flap systems.

ESDU 89047

In-plane forces and moments on installed inclined propellers at low forward speeds.

ESDU 06012

The influence of propeller slipstream on aircraft rolling moment due to sideslip.

ESDU 06013

Propeller slipstream modelling for incidence and sideslip.

ESDU TM 193

Example of procedure in calculation of effect of propeller slipstream on horizontal tailplane flow-field.

☐ Section 37: Powerplant/Airframe Interactions - Jet Powered Aircraft

ESDU 82034

Aircraft forces due to interference between a jet efflux and a slotted flap.

☐ Section 38: Stability of Aircraft - General

ESDU 86021

Introduction of aerodynamic derivatives, equations of motion and stability (including the classical criteria of longitudinal stability and control, and description of the lateral modes of motion).

ESDU 86041

Conversion of stability derivatives for a general change of body axes.

ESDU 13005

Information on the use of Data Items on the longitudinal stability of aircraft.

ESDU AERO A.06.01.00

Information on the use of Data Items on rolling moment derivatives of an aircraft.

ESDU AERO A.07.01.00

Information on the use of Data Items on yawing moment and sideforce derivatives of an aircraft.

☐ Section 39: Stability of Aircraft - Longitudinal Stability - Ground Effect, Downwash, Tandem Lifting Surfaces, Tailplane

ESDU 72023

Low-speed longitudinal aerodynamic characteristics of aircraft in ground effect.

ESDU 80020

Average downwash at the tailplane at low angles of attack and subsonic speeds.

ESDU 81023

Lift and drag of two staggered lifting surfaces at low speeds.

ESDU 89029

Installed tailplane lift-curve slope at subsonic speeds.

ESDU 91009

Effect of twin fins on isolated tailplane lift-curve slope.

ESDU 97021

Effect of trailing-edge flap deployment on average downwash at the tailplane at low speeds.

ESDU AERO W.05.01.01

Kinetic pressure in the wake behind a wing.

☐ Section 40: Stability of Aircraft - Longitudinal Stability - Derivatives due to Rate of Pitch

ESDU 90010

Pitching moment and lift force derivatives due to rate of pitch for aircraft at subsonic speeds.

ESDU 91004

Pitching moment derivative due to rate of pitch for projectiles at supersonic speeds.

ESDU AERO W.S.08.03.02

Pitching velocity derivatives for wings at supersonic speeds Zq and Mq.

☐ Section 41: Stability of Aircraft - Pitch-Break Characteristics

ESDU 01005

Effect of geometry on low speed pitch-break characteristics of swept wings.

☐ Section 42: Stability of Aircraft - Lateral Stability - Derivatives due to Sideslip

ESDU AERO A.06.01.03

Stability derivative (Lv) Contribution of full-span dihedral to rolling moment due to sideslip.

ESDU AERO A.06.01.09

Stability derivative (Lv) Contribution of part-span dihedral to rolling moment due to sideslip.

ESDU 73006

Effects of isolated body and wing-body interference on rolling moment due to sideslip: Lv (with Addendum A for nacelle effects).

ESDU 79006

Wing-body yawing moment and sideforce derivatives due to sideslip: Nv and Yv (with Addendum A for nacelle effects).

ESDU 80033

Contribution of wing planform to rolling moment derivative due to sideslip, (Lv)w, at subsonic speeds.

ESDU 80034

Effect of trailing-edge flaps on rolling moment derivative due to sideslip, (Lv)f.

ESDU 81013

Effect of trailing-edge flaps on sideforce and yawing moment derivatives due to sideslip, (Yv)f and (Nv)f.

ESDU 81032

Estimation of rolling moment derivative due to sideslip for complete aircraft at subsonic speeds.

ESDU TM 49

Contribution to rolling moment derivative due to sideslip resulting from interference effect of fin on tailplane, (Lv)TH.

ESDU 82010

Contribution of fin to sideforce, yawing moment and rolling moment derivatives due to sideslip,(Yv)F, (Nv)F, (Lv)F, in the presence of body, wing and tailplane.

ESDU 82011

Estimation of sideforce and yawing moment derivatives due to sideslip for complete aircraft at subsonic speeds.

ESDU 91031

Contribution of fin and tailplane to sideforce and yawing moment derivatives due to sideslip at supersonic speeds at low angle of attack.

ESDU 92007

Contribution of tailplane-mounted twin fins to sideforce, yawing moment and rolling moment derivatives due to sideslip at subsonic speeds.

ESDU 92029

Contribution of ventral fins to sideforce and yawing moment derivatives due to sideslip at low angle of attack.

ESDU 93007

Contribution of body-mounted fins and tailplanes to lateral derivatives due to sideslip at subsonic speeds for general body width to height ratio.

ESDU 00025

Computer program for prediction of aircraft lateral stability derivatives in sideslip at subsonic speeds.

ESDU TM 178

Effect of wing-mounted engine nacelles of propeller-driven aircraft on lateral stability derivatives in sideslip

ESDU AERO C.01.01.01

Lift-curve slope for single fin and rudder. (i) Body shape merging into fin.

ESDU AERO A.S.01.03.02

Lift-curve slope of isolated lifting surface at supersonic speeds.

ESDU AERO A.S.06.03.04

Spanwise center of pressure of isolated lifting surface at supersonic speeds.

ESDU TM 184

Effects of rear-mounted engine nacelles on sidewash at Fin.

☐ Section 43: Stability of Aircraft - Lateral Stability - Derivatives due to Rate of Roll

ESDU AERO A.06.01.01

Stability derivative Lp rolling moment due to rolling for swept and tapered wings.

ESDU 81014

Contribution of wing planform to derivatives of yawing moment and sideforce due to roll rate at subsonic speeds (Np)w and (Yp)w.

ESDU 83006

Contribution of fin to sideforce, yawing moment and rolling moment derivatives due to rate of roll, (Yp)F, (Np)F, (Lp)F, in the presence of body, wing and tailplane.

ESDU 85006

Contribution of wing dihedral to sideforce, yawing moment and rolling moment derivatives due to rate of roll at subsonic speeds, (Yp)□, (Np)□ and (Lp)□.

ESDU 85010

Estimation of sideforce, yawing moment and rolling moment derivatives due to rate of roll for complete aircraft at subsonic speeds.

ESDU AERO A.S.06.03.01

Stability derivative Lp rolling moment due to rolling for wings at supersonic speeds.

ESDU AERO A.S.06.03.02

Stability derivative Lp. Effect of fuselage interference on rolling moment due to rolling at supersonic speeds.

ESDU AERO A.S.06.03.03

Stability derivative Lp. Rolling moment due to rolling for radial multi-planar wing arrangements at supersonic speeds.

☐ Section 44: Stability of Aircraft - Lateral Stability - Derivatives due to Rate of Yaw

ESDU 71017

Aero-normalized stability derivatives: effect of wing on yawing moment due to yawing.

ESDU 72021

Effect of wing on rolling moment due to yawing.

ESDU 82017

Contribution of fin to sideforce, yawing moment and rolling moment derivatives due to rate of yaw, (Yr)F, (Nr)F, (Lr)F.

ESDU 83026

Contribution of body to yawing moment and sideforce derivatives due to rate of yaw, (Nr)B and (Yr)B.

ESDU 84002

Estimation of sideforce, yawing moment and rolling moment derivatives due to rate of yaw for complete aircraft at subsonic speeds.

☐ Section 45: Unsteady Aerodynamics

ESDU 82020

Introduction to unsteady aerodynamics.

ESDU 81034

Linearized two-dimensional oscillatory airforce coefficients and load distributions on thin aerofoils in subsonic flow.

ESDU 82005

Linearized two-dimensional oscillatory airforce coefficients and load distributions on thin aerofoils in supersonic flow.

ESDU 83010

Oscillatory aerodynamics of slender bodies.

ESDU 84020

An introduction to time-dependent aerodynamics of aircraft response, gusts and active controls.

ESDU 87012

An introduction to aircraft buffet and buffeting.

ESDU 90005

Frequencies of resonance in wind tunnels with ventilated walls and plenum chamber.

☐ Section 46: Parachute Aerodynamics

ESDU 09012

Aerodynamics of Parachutes.

☐ Section 47: Bluff Bodies and Structures - Mean Forces

ESDU 71012

Fluid forces on non-streamline bodies - background notes and description of the flow phenomena.

ESDU 71016

Fluid forces, pressures and moments on rectangular blocks.

ESDU 79026

Mean fluid forces and moments on cylindrical structures: polygonal sections with rounded corners including elliptical shapes.

ESDU 80003

Mean fluid forces and moments on rectangular prisms: surface-mounted structures in turbulent shear flow.

ESDU 80025

Mean forces, pressures and flow field velocities for circular cylindrical structures: single cylinder with two-dimensional flow.

ESDU 81017

Mean forces, pressures, and moments for circular cylindrical structures: finite-length cylinders in uniform and shear flow.

☐ Section 48: Bluff Bodies and Structures - Fluctuating Forces and Response

ESDU 77032

Fluctuating loads and dynamic response of bodies and structures in fluid flows - background information.

ESDU 79025

Fluctuating response of circular cylinders in small groups in fluid flow - discussion and guide to data available.

ESDU 87035

Calculation methods for along-wind loading. Part 2. Response of line-like structures to atmospheric turbulence.

☐ Section 49: Aerodynamic Heating and Heat Transfer

ESDU 69009

Heat balance for flight vehicles.

ESDU 69010

Heat transfer by forced convection between a two-dimensional laminar boundary layer and a smooth flat plate, with application to wedges, cylinders and cones.

ESDU 69011

Heat transfer by forced convection between a two-dimensional turbulent boundary layer and a smooth flat plate, with application to wedges, cylinders and cones.

ESDU 69012

Effects of kinetic heating on equilibrium temperature of flight vehicles.

ESDU AERO 00.02.05

Heat transfer under conditions of forced convection for the subsonic turbulent flow of gases in smooth straight ducts of constant cross section.

ESDU AERO 00.03.26

Wall and average gas temperatures for subsonic turbulent flow with heat transfer in ducts of constant circular cross section.

ESDU AERO W.S.00.03.18

Aerodynamic heating: temperatures at a perfectly insulated surface neglecting radiation.

☐ Section 50: Wind-Tunnel Corrections

ESDU 76028

Lift-interference and blockage corrections for two-dimensional subsonic flow in ventilated and closed wind-tunnels.

ESDU 80024

Blockage corrections for bluff bodies in confined flows.

Aircraft Noise

☐ Section 1: Organizational Documents

ESDU 00010

Aircraft Noise Series: record of documents.

☐ Section 2: General

ESDU 02020

An introduction to aircraft noise.

ESDU 09009

Aircraft noise prediction.

ESDU 66016

Bandwidth correction.

ESDU 66017

Combination of levels in dB.

ESDU 08018

Combination of spectra in Common Data Files from ESDU Aircraft Noise Data Items.

ESDU 17011 (supersedes ESDU 66016)

Power spectral density and bandwidth correction of spectrum level.

ESDU 17012 (supersedes ESDU 66017)

Combination of levels in dB.

☐ Section 3: Noise Reduction

ESDU 74003

Normal incidence absorption coefficients and acoustic impedances of typical single layer fibrous lining materials.

ESDU 74004

Normal incidence absorption coefficients and acoustic impedances of single layer perforated sheet liners.

ESDU 00012
The acoustic attenuation of absorbent linings in cylindrical flow ducts.

ESDU 00024
The acoustic attenuation of absorbent linings in rectangular flow ducts with application to annular flow ducts.

ESDU 01015
Far-field sound radiation from circular ducts.

☐ Section 4: Noise Estimation - Gas Turbine Engine Noise Sources

ESDU 75020
Estimation of far-field sound pressure levels due to buzz-saw noise of a supersonic fan or compressor.

ESDU 13001
The prediction of shock noise from supersonic jets including the near-field.

ESDU 98008

Prediction of noise generated by fans and compressors in turbojet and turbofan engines.

ESDU 05001

Prediction of combustor noise from gas turbine engines.

ESDU 12001

Prediction of turbine noise from aero-engines.

☐ Section 5: Noise Estimation - Near-Field Jet

ESDU 99006

Computer-based estimation procedure for near-field single-stream jet noise.

☐ Section 6: Noise Estimation - Far-Field Jet

ESDU 98019

Computer-based estimation procedure for single-stream jet noise. Including far-field, static jet mixing noise database for circular nozzles.

ESDU 11002

The prediction of the far-field mixing noise from coaxial subsonic jets based on a database for stationary coplanar conical nozzles.

ESDU 89041

☐ Estimation of subsonic far-field jet-mixing noise from single-stream circular nozzles.

Section 7: Noise Estimation - Jet Static-to-Flight Correction

ESDU 87011

Prediction of single-stream jet noise in flight from static circular-nozzle data.

ESDU 14014

☐ A theoretically-based method for predicting static-to-flight effects on coaxial jet noise.

Section 8: Noise Estimation - Miscellaneous Sources

ESDU 75021

Estimation of the surface pressure fluctuations in the turbulent boundary layer of a flight vehicle.

ESDU TM 58

ESDU TECHNICAL MEMORANDUM
Comparison of surface pressure fluctuations in a turbulent boundary layer as measured on various flight vehicles.

ESDU 90023

Airframe noise prediction.

ESDU TM 198

☐ Estimating the reflection effects for the jet noise under-wing engines.

Section 9: Noise Estimation - Propeller Sources

ESDU 76020

Estimation of the maximum discrete frequency noise from isolated rotors and propellers.

ESDU 11005

Prediction of near-field and far-field harmonic noise from subsonic propellers with non-axial inflow.

ESDU 96027

☐ Estimation of the unsteady lift coefficient of subsonic propeller blades in non-axial inflow.

Section 10: Sound Propagation - Atmospheric Attenuation

ESDU 78002

Evaluation of the attenuation of sound by a uniform atmosphere.

ESDU 78003

☐ Evaluation of the attenuation of broad-band sound by a non-uniform still atmosphere.

☐ Section 11: Sound Propagation - Lateral Attenuation and Overground Sound Propagation

ESDU 81035

An introduction to aircraft noise lateral attenuation.

ESDU 82027

Estimation of lateral attenuation of air-to-ground jet or turbofan aircraft noise in one-third octave bands.

ESDU 82027 Addendum

Estimation of lateral attenuation of air-to-ground jet or turbofan aircraft noise in one-third octave bands. Addendum - Estimation of sideline noise in subjective noise metrics.

ESDU 94036

The prediction of sound attenuation as a result of propagation close to the ground.

☐ Section 12: Sound Propagation - Ground Reflection, Wind/Temperature Effects

ESDU 04011

Prediction of sound attenuation in a refracting turbulent atmosphere with a Fast Field Program.

ESDU 89036

The calculation of overground sound propagation in the presence of wind and temperature gradients.

ESDU 94035

The correction of measured noise spectra for the effects of ground reflection.

☐ Section 13: Noise Shielding

ESDU 79011

Estimation of noise shielding by barriers.

ESDU 88023

Jet-by-jet shielding of noise.

☐ Section 14: Internal Noise

ESDU 02008

Aerodynamics and aero-acoustics of rectangular planform cavities. Part I: Time-averaged flow.

ESDU 04023

Aerodynamics and aero-acoustics of rectangular planform cavities. Part II: Unsteady flow and aero-acoustics.

ESDU 07001

Noise transmission into aircraft cabins.

ESDU 07001 Addendum

Noise transmission into aircraft cabins. Addendum: Estimation of section properties of fuselage stiffeners. pnl.

Composites

☐ Section 1: Organizational Documents

ESDU 02015

Composites series organization: preface, amendment record.

ESDU CFS

Conversion factors.

☐ Section 2: Laminated Composites

ESDU 82013

Laminate stacking sequences for special orthotropy. (Application to fibre reinforced composites).

ESDU 83035

Estimation of the stiffnesses and apparent elastic properties of laminated flat plates.

ESDU 85001

Elastic stress and strain distributions around circular holes in infinite plates of orthotropic material (applicable to fibre reinforced composites).

ESDU 86003

Example of the use of Data Item No. 85001. Choice of reinforcement for a circular hole in a fibre reinforced laminated plate. (Data relating to one particular set of laminate properties).

ESDU 89013

Transverse (through-the-thickness) shear stiffnesses of fibre reinforced composite laminated plates.

ESDU 94003

Stiffnesses of laminated flat plates.

ESDU 94004

Stress analysis of laminated flat plates.

ESDU 96036

Design of laminated plates subjected to in-plane loads and bending moments.

ESDU 03013

Thickness selection for the flanges and web of a composite I-section beam subjected to bending and shear.

☐ Section 3: Buckling of Balanced Laminated Composites

ESDU 73007

Stiffness of loaded flat strips under sinusoidally distributed bending couples at their edges (for use in local buckling calculations). (Uniaxial or biaxial loading. Isotropic or orthotropic materials).

ESDU 73015

Estimation of the local buckling stress under biaxial compression of an isotropic skin with fibre reinforced integral unflanged stiffeners.

ESDU 80023

Buckling of rectangular specially orthotropic plates.

ESDU 81047

Buckling of flat rectangular plates (isotropic, orthotropic and laminated composite plates and sandwich panels).

ESDU 94005

Buckling of flat rectangular orthotropic plates.

ESDU 94007

Elastic buckling of cylindrically curved laminated fibre reinforced composite panels with all edges simply-supported under biaxial loading.

ESDU 03001

Elastic buckling of long, flat, symmetrically-laminated (AsBoDf), composite stiffened panels and struts in compression.

☐ Section 4: Buckling of Unbalanced Laminated Plates

ESDU 94006

Elastic buckling of unbalanced laminated fibre reinforced composite plates. (Rectangular plates of AsBtDs type, all edges simply-supported under biaxial loading).

☐ Section 5: Sandwich Panels with Composite Face Plates

ESDU 87013

Elastic wrinkling of sandwich columns and beams with unbalanced laminated fibre reinforced face plates (face plates of AsBoDs, AsBlDs and AsBsDs types).

ESDU 88015

Elastic wrinkling of sandwich panels with laminated fibre reinforced face plates (face plates of AsBoDs, AsBlDs and AsBsDs types).

☐ Section 6: Composite Plates under Pressure

ESDU 93011

Flat rectangular orthotropic plates under uniformly distributed normal pressure. Elastic stresses and deflections for various forms of edge restraint.

☐ Section 7: Failure Criteria

ESDU 82025

Failure modes of fibre reinforced laminates.

ESDU 83014

Failure criteria for an individual layer of a fibre reinforced composite laminate under in-plane loading.

ESDU 84018

Failure analysis of fibre reinforced composite laminates.

ESDU 91003

Delamination of tapered composites.

ESDU 94019

Through-the-thickness stresses and failure in the corner radius of a laminated composite section.

ESDU 95028

Delamination and free edge stresses in composite laminates subjected to uniform prescribed axial strain and temperature change.

☐ Section 8: Bonded Joints

ESDU 17004

Guide to the use of Data Items in the design of bonded joints.

ESDU 78042

Shear stresses in the adhesives in bonded joints. Single step double lap joints loaded in tension.

ESDU 79016

Inelastic shear stresses and strains in the adhesives bonding lap joints loaded in tension or shear.

ESDU 80011

Elastic stresses in the adhesive in single step double lap bonded joints.

ESDU 80039

Elastic adhesive stresses in multistep

☐ Section 9: Damping and Response to Acoustic Loading

ESDU 85012

Estimation of damping in laminated and fibre-reinforced plates.

ESDU 84008

Estimation of r.m.s. strain in laminated skin panels subjected to random acoustic loading.

ESDU 86024

Estimation of r.m.s. strain in laminated face plates of simply-supported sandwich panels subjected to random acoustic loading. Including a simplified natural frequency prediction method.

ESDU 84027

Endurance of fibre-reinforced composite, laminated structural elements subjected to simulated random acoustic loading.

Section 10: Natural Modes of Vibration

ESDU 83036

Natural frequencies of rectangular, especially orthotropic laminated plates.

ESDU 85037

Natural frequencies of simply-supported sandwich panels with laminated face plates.

ESDU 89011

Natural frequencies of singly-curved laminated plates with simply-supported edges.

ESDU 90016

Natural frequencies of isotropic and orthotropic rectangular plates under static in-plane loading (including shear loading).

ESDU TM 71

ESDU TECHNICAL MEMORANDUM
A Rayleigh-Ritz method of analysis for vibration of orthotropic plates under static in-plane loading (including shear).

Dynamics

☐ Section 1: Organizational Documents

ESDU 00003

Dynamics Series record of documents.

ESDU CFA

Conversion factors.

☐ Section 2: Aircraft Equations of Motion

ESDU 67001

Introduction to notation for aircraft dynamics.

ESDU 67002

Notation for aircraft dynamics.

ESDU 67003

The equations of motion of a rigid aircraft.

ESDU 67004

Conversion formulae for rotation and translation of body axes.

ESDU 67036

Geometric and kinematic relationships for various axis systems.

ESDU 67037

Direction and incidence angles.

ESDU 67038

Measures of damping.

ESDU 98024

Quaternion representation of aeroplane attitude and motion characteristics.

☐ Section 3: Aircraft Lateral Motion

ESDU 67005

Introduction to inertia cross-coupling of the lateral and longitudinal motions during a rapid rolling manoevre.

ESDU 67006

Inertia cross-coupling during a rapid rolling manoevre. Theoretical background and discussion of simplified stability boundaries.

ESDU 67007

Inertia cross-coupling during a rapid rolling manoevre. Estimation of critical roll rate.

ESDU 83024

Approximation to the roots of the lateral equations of motion of an aircraft with and without a simple yaw damper.

☐ Section 4: Aircraft Handling Qualities

ESDU 92006

A background to the handling qualities of aircraft.

☐ Section 5: Aircraft Response

ESDU 04024

An introduction to rigid aeroplane response to gusts and atmospheric turbulence.

☐ Section 6: Aircraft Loading

ESDU 94009

Symmetric steady manoevre loads on rigid aircraft of classical configuration at subsonic speeds.

ESDU 94045

Shear force, bending moment and torque of rigid aircraft in symmetric steady maneuvering flight.

ESDU 01010

Loading on a rigid aeroplane in steady lateral manoeuvres.

☐ Section 7: Aeroelasticity

ESDU 96037

A qualitative introduction to static aeroelasticity: controllability, loads, and stability.

ESDU 97032

Static aeroelasticity: a formal analysis using assumed modes.

ESDU 99033

Static aeroelasticity: a formal analysis using normal modes.

ESDU 03011

An introduction to lateral static aeroelasticity: controllability, loads, and stability.

☐ Section 8: Design of Linear Systems

ESDU 74019

The stability and response of linear systems. Part 1: Introduction.

ESDU 74020

The stability and response of linear systems. Part II: methods of displaying stability characteristics.

ESDU 74021

The stability and response of linear systems. Part III: methods of analysis based on frequency response.

ESDU 80002

The stability and response of linear systems. Part IV: specification and measures of system performance.

ESDU 80018

The stability and response of linear systems. Part V: control of dynamic systems.

ESDU 81008

The stability and response of linear systems. Part VI: selection of an assessment method.

ESDU 81040

The stability and response of linear systems. Part VII: examples.

☐ Section 9: Response of First- and Second-Order Systems

ESDU 69005

The response of first- and second-order systems.

ESDU 82037

The response of two-degree-of-freedom systems (computer program).

☐ Section 10: Mathematical Techniques

ESDU 69025

Solutions of ordinary linear differential equations by the Laplace transform method.

ESDU 83041

A summary of the concepts relating to random processes.

ESDU 85046

Quadrature methods for the evaluation of definite integrals.

ESDU 86011

Numerical methods for the solution of ordinary differential equations: initial value problems.

☐ Section 11: Design of Nonlinear Systems

ESDU 84009

Nonlinear systems: an introduction to Describing Functions.

ESDU 84032

Nonlinear systems: the Describing Function method for closed-loop system response.

☐ Section 12: Servomechanisms

ESDU 85026

Servomechanism transfer functions.

☐ Section 13: Sampled-Data Systems

ESDU 86037

An introduction to the Z-transform and its application to sampled-data systems.

ESDU 92044

Analogue to digital transformation.

☐ Section 14: Parameter Estimation

ESDU 87039

Parameter estimation of linear systems in the absence of process noise: (i) methods based on the least-squares principle.

ESDU 88011

Parameter estimation of linear systems in the absence of process noise: (ii) the Maximum Likelihood method.

ESDU 88039

The Kalman filter.

ESDU 89032

Parameter estimation of linear systems in the presence of process noise using the Maximum Likelihood method.

ESDU 90006

Parameter estimation of linear systems from frequency response measurements.

ESDU 93016
Parameter estimation of linear systems from frequency response measurements (computer program).

Fatigue – Endurance Data

☐ Section 1: Organizational Documents

ESDU 04017

Fatigue - Endurance Data Series organization: preface amendment record.

☐ Section 2: Endurance Data - General

ESDU CFS

Conversion factors.

ESDU FAT A.00.01

The effect of mean stress on fatigue strength (plain test piece).

ESDU FAT A.00.02

The effect of mean stress on fatigue strength (test piece with stress concentration).

ESDU 19004

Guide to the effect of shot peening on fatigue strength.

ESDU 67014

Fatigue strength of thick cylinders under internal pressure.

ESDU 70016

Terms and notation for fatigue endurance data.

ESDU 70018

General principles of design in relation to fatigue.

ESDU 90031

Fretting fatigue.

ESDU 92015

Guide to the effect of shot peening on fatigue strength.

ESDU 04022

An introduction to low-cycle fatigue phenomena.

ESDU 11003

Cyclic stress-strain and strain-life properties for metallic materials.

☐ Section 3: Aluminium Alloys - Endurance Data

ESDU FAT E.07.01

Endurance of aluminium alloys (unclad) (in bending).

ESDU FAT E.07.02

Notes supplementary to E.07.01 on the fatigue strength of aluminium alloys.

ESDU FAT E.07.03

The effect of mean stress on the endurance of aluminium alloys.

ESDU 74038

Effect of an axial compressive mean stress on the fatigue strength of aluminium alloy bar (plain and notched).

ESDU 87026

Fatigue strength of anodized aluminium alloy.

ESDU 89004

Effect of fretting on fatigue strength of aluminium alloys.

☐ Section 4: Titanium Alloys - Endurance Data

ESDU 19001

Fatigue of wrought and cast titanium alloys in bending and under axial loading.

ESDU 19002

Fatigue of wrought and cast Ti-6Al-4V alloys.

ESDU 77027

Fatigue of wrought and cast Ti-6Al-4V titanium alloy. (In bending and under axial loading.)

ESDU 77033

Fatigue of wrought and cast annealed Ti-5Al-2.5Sn

titanium alloy. (In bending and under axial loading.)

ESDU 78014

Fatigue of wrought titanium alloys Ti-6Al-6V-2Sn and Ti-4Al-4Mo-2Sn-0.5Si.

ESDU 88027

☐ Effect of fretting on fatigue strength of titanium alloys.

Section 5: Steels - Endurance Data

ESDU 71027

Endurance of high strength steels (in bending).

ESDU 74016

The fatigue strength at high endurance of notched low alloy steel specimens (in bending and under axial loading, zero mean stress).

ESDU 74027

The effect of surface roughness on the fatigue limit of steels (at zero mean stress).

ESDU 86033

The effect of electrodeposited chromium on the fatigue strength of low alloy steel.

ESDU 88008

Fatigue limit of unnotched steels (related to tensile strength).

ESDU 04019

☐ Endurance of high-strength steels.

Section 6: Statistical Methods

ESDU 91041

The statistical analysis of data from Normal distributions, with particular reference to small samples.

ESDU 92040

An introduction to the statistical analysis of engineering data.

ESDU 21004

☐ The statistical analysis of fatigue data using the Weibull distribution.

Section 7: Endurance Estimates - Constant or Variable Amplitude Loading

ESDU 69024

The cumulative damage of aluminium alloy specimens under variable amplitude fatigue loading.

ESDU 76014

Estimation of endurance and construction of constant amplitude S-N curves from related data corrected for notch and mean stress effects.

ESDU 95006

Fatigue life estimation under variable amplitude loading using cumulative damage calculations.

ESDU 97018

Standard fatigue loading sequences.

ESDU 97024

☐ Derivation of endurance curves from fatigue test data, including run-outs.

Section 8: Life Estimation of Structures

ESDU 69023

Average gust frequencies. Subsonic transport aircraft.

ESDU 75008

Frequencies of vertical and lateral load factors resulting from ground manoeuvres of aircraft.

ESDU 79024

☐ Estimation of the endurance of civil aircraft wing structures.

Section 9: Stress Concentrations

ESDU 64001

Guide to stress concentration data.

ESDU 67023

Geometric stress concentrations. Two equal unreinforced circular holes in infinite flat plates.

ESDU 71011

Stresses due to interference-fit pins and bushes in plates, strips, or lugs.

ESDU 75007

Geometric stress concentration factors: two adjacent unreinforced circular holes in infinite flat plates.

ESDU 75033

Elastic stress concentration factors. Double radius fillets in shouldered shafts in torsion.

ESDU 79008

Elastic stress concentration factors. Rectangular notch in the edge of a wide flat plate in tension.

ESDU 80027

Elastic stress concentration factors. Single reinforced and unreinforced holes in infinite plates of isotropic materials.

ESDU 81006

Stress concentration factors. Axially loaded lugs with clearance-fit pins.

ESDU 85045

Stress concentrations: interaction and stress decay for selected cases.

ESDU 89048

Elastic stress concentration factors. Geometric discontinuities in rods and tubes of isotropic materials.

ESDU 93030

Three-dimensional elastic stress concentration factors. Plain or countersunk hole in a wide plate subjected to tension, bending, or pin loading.

ESDU 09014

☐ Elastic stress concentration factors. Geometric discontinuities in flat bars or strips of isotropic material.

Section 10: Screw Threads

ESDU 67020

Fatigue strength of steel screw threads with large root radii under axial loading.

ESDU 67034

Effect of inclined nut seatings on the fatigue strength of steel screw threads.

ESDU 68045

Fatigue strength of large steel screw threads under axial loading.

ESDU 83012

Fatigue strength of cold-rolled titanium alloy screw threads under axial load (room temperature and elevated temperatures).

ESDU 84037

☐ Fatigue strength of external and internal steel screw threads under axial loading. (Standard forms not greater than 1.0 inch diameter.)

Section 11: Structural Joints

ESDU FAT E.05.01

Endurance of structural joints. (Aluminium alloy material - tensile loading.)

ESDU FAT E.05.06

Endurance of bonded lap joints. (Aluminium alloy sheet material; phenolic resin/vinyl powder glue, tensile loading.)

ESDU FAT E.05.07

Endurance of bonded double strap joints. (Aluminium alloy sheet material; phenolic resin/vinyl powder glue, tensile loading.)

ESDU 79031

Endurance of riveted lap joints (aluminium alloy sheet and rivets).

ESDU 89046

Fatigue of aluminium alloy joints with various fastener systems. Low load transfer.

ESDU 90009

Fatigue of aluminium alloy joints with various fastener systems. Medium load transfer.

ESDU 90018

☐ Fatigue of aluminium alloy joints with various fastener systems. High load transfer.

Section 12: Lugs

ESDU FAT A.05.02

Estimation of endurance of pin joints.

ESDU 77017

Endurance of titanium alloy lugs (Ti-6Al-4V, annealed and Ti-4Al-4Mo-2Sn-0.5Si).

ESDU 80007

Endurance of aluminium alloy lugs with nominally push-fit pins (tensile mean stress).

ESDU 82022

Endurance of steel lugs with clearance-fit pins (Tensile mean stress).

ESDU 84025

Fatigue Fracture Mechanics

☐ Section 1: Organizational Documents

ESDU 04018

Fatigue - Fracture Mechanics Series organization: preface amendment record.

☐ Section 2: Fracture Mechanics Data - General ESDU CFS

Conversion factors.

ESDU 23012

Guide to available fatigue crack propagation rate data

ESDU 80036

Introduction to the use of linear elastic fracture mechanics in estimating fatigue crack growth rates and residual strength of components.

ESDU 84001

Growth of cracks under constant amplitude fatigue loading: example calculations.

ESDU 91027

Non-destructive examination - choice of methods.

☐ Section 3: Aluminium Alloys - Crack Propagation

ESDU 81031

Fatigue crack propagation rates and threshold stress intensity factor ranges for aluminium alloy plate, extruded bar and forgings.

ESDU 83007

Fatigue crack propagation rates and threshold stress intensity factor ranges for aluminium alloy sheet.

ESDU 88007

Effect of environment on fatigue crack propagation in aluminium alloy sheet and plate.

ESDU 91015

Fatigue crack propagation rates of experimental aluminium lithium sheet and plate alloys.

ESDU 92030

Fatigue propagation behavior of short cracks in aluminium alloys.

☐ Section 4: Steels - Crack Propagation

ESDU 84003

Fatigue crack propagation rates and threshold stress intensity factors in high alloy and corrosion resistant (stainless) steel.

ESDU 93033

Fatigue propagation behavior of short cracks (1-2 mm) in steels.

☐ Section 5: Titanium Alloys - Crack Propagation

ESDU 82015

Fatigue crack propagation rates and threshold stress intensity factor ranges for titanium alloy plate, bar and forgings.

ESDU 89051

Fatigue crack propagation rates for titanium alloy sheets.

ESDU 90028

Effect of environment on fatigue crack propagation rate in titanium alloy sheet and plate.

ESDU 92023

Fatigue propagation behavior of short cracks in titanium alloys.

☐ Section 6: Stress Intensity Factors

ESDU 22002

Rooke and Cartwright's compendium of stress intensity factors

ESDU 78036

The compounding method of estimating stress intensity factors for cracks in complex configurations using solutions from simple configurations.

ESDU 81029

Stress intensity factors in lugs (through-thickness cracks).

ESDU 83033

Stress intensity factors for corner cracks in loaded holes in lugs and wide plates.

☐ Section 7: Crack Resistance Curves - Aluminium, Aluminium-Lithium and Titanium Alloys and Steels

ESDU 85031

Crack resistance curves.

ESDU 20003

Crack resistance curves.

Fluid Mechanics, Internal Flow

☐ Section 1: Organizational Documents

ESDU 04021

Fluid Mechanics, Internal Flow Series: Record of Documents.

☐ Section 2: General

ESDU CFA

Conversion factors.

ESDU FMI1

Introductory memorandum on the pressure losses in internal flow systems.

ESDU 12003

Pressure and Flow Measurements.

Section 3: Compressible Flow Relationships

ESDU 67035

Jet flow parameters.

ESDU 74028

One-dimensional compressible gas flow in ducts.

ESDU 95011

One-dimensional representation of steady, spatially non-uniform flow. An equivalent mean-value set for compressible flow. Part 1. Implementation for an ideal, calorically-perfect gas.

ESDU 97029

One-dimensional representation of steady, spatially non-uniform flow. An equivalent mean-value set for compressible flow. Part 2. Implementation for an ideal, thermally-perfect gas.

ESDU 03012

Computer program for calculation of mean value properties for non-uniform compressible flows.

ESDU TM 148

ESDU TECHNICAL MEMORANDUM
The implications of flow property profiles on determination and application of non-dimensional pressure loss coefficients for flow of incompressible fluids.

☐ Section 4: Straight Pipes

ESDU 66027

Friction losses for fully-developed flow in straight pipes.

ESDU 74029

Friction losses for fully-developed flow in straight pipes of constant cross section - subsonic compressible flow of gases.

ESDU 79014

Losses caused by friction in straight pipes with systematic roughness elements.

ESDU TN 08008

CFD studies for the validation of friction losses and flow characteristics in circular straight pipes with smooth walls.

ESDU TN 08009

CFD validation studies for transitional flow in circular straight pipes with smooth walls

☐ Section 5: Bends, Branches and Junctions

ESDU 73022

Pressure losses in three-leg pipe junctions: dividing flows.

ESDU 73023

Pressure losses in three-leg pipe junctions: combining flows.

ESDU 83037

Pressure losses in curved ducts: single bends.

ESDU 77009

Pressure losses in curved ducts: interaction factors for two bends in series.

ESDU 77029

Pressure losses in curved ducts: coils.

☐ Section 6: Duct Fittings and Equipment

ESDU 66030

Pressure losses in flowmetering devices.

ESDU 69022

Pressure losses in valves.

ESDU 72009

Pressure drop in ducts across round-wire gauzes normal to the flow.

ESDU 74040

Pressure loss during crossflow of fluids with heat transfer over plain tube banks without baffles.

ESDU 79034

Crossflow pressure loss over banks of plain tubes in square and triangular arrays including effects of flow direction.

ESDU 81021

Pressure losses caused by obstructions in ducts or pipes.

ESDU 81039

Flow of liquids. Pressure losses across orifice plates, perforated plates and thick orifice plates in ducts.

ESDU 82009

Compressible flow of gases. Pressure losses and discharge coefficients of orifice plates, perforated plates and thick orifice plates in ducts.

ESDU TN 07007

Incompressible flow through orifice plates - a review of the data in the literature.

ESDU TN 10013

CFD validation studies for incompressible flow through square-edged orifice plates.

☐ Section 7: Ejectors and Jet Pumps

ESDU 92042

Ejectors and jet pumps: computer program for design and performance for compressible gas flow.

ESDU 93022

Ejectors and jet pumps: computer program for design and performance for liquid flow.

ESDU 85032

Ejectors and jet pumps. Design and performance for incompressible liquid flow.

ESDU 86030

Ejectors and jet pumps. Design for steam driven flow.

ESDU 94046

Ejectors and jet pumps: computer program for design and performance for steam/gas flow.

☐ Section 8: Duct Expansions

ESDU 72011

Flow through a sudden enlargement of area in a duct.

ESDU 76027

Introduction to design and performance data for diffusers.

ESDU 73024

Performance of conical diffusers in incompressible flow.

ESDU 74015

Performance in incompressible flow of plane-walled diffusers with single-plane expansion.

ESDU 75026

Performance of circular annular diffusers in incompressible flow.

ESDU 87015

Performance improvement of axial diffusers for incompressible flow.

ESDU 90025

Performance of conical diffusers in subsonic compressible flow.

ESDU TM 19

ESDU TECHNICAL MEMORANDUM
Effects of truncation on diffuser performance.

☐ Section 9: Duct Contractions

ESDU 05024

Flow through sudden contractions of duct area: pressure losses and flow characteristics.

ESDU TN 06023

CFD validation studies for pressure loss and flow characteristics in sudden contractions.

☐ Section 10: Rotating Machinery

ESDU 07004

Flow in rotating components - discs, cylinders and cavities.

ESDU 09004

Labyrinth seal flow.

ESDU 15012

Flow in rotating cavities.

☐ Section 11: Two-Phase Flow - Guides to Pressure Drop Related Problems

ESDU CF2

Conversion factors for fluid flows.

ESDU FMI2

Guide to the flow relationships and statistical methods used in the Data Items on two-phase flow pressure gradients in straight pipes.

ESDU 78018

Guide to calculation procedures for solving typical problems related to pressure drop in two-phase flow.

ESDU 88014

Computer program for the prediction of air-lift pump performance.

☐ Section 12: Two-Phase Flow - Pressure Losses in Pipes

ESDU 76018

The frictional component of pressure gradient for two-phase gas or vapor/liquid flow through straight pipes.

ESDU 01014

Frictional pressure gradient in adiabatic flows of gas-liquid mixtures in horizontal pipes: prediction using empirical correlations and database.

ESDU 04006

Pressure gradient in upward adiabatic flows of gas liquid mixtures in vertical pipes.

ESDU 77016

The gravitational component of pressure gradient for two-phase gas or vapor/liquid flow through straight pipes.

ESDU 78001

The momentum-change component of pressure change in two-phase flow and other non-equilibrium effects.

ESDU 89012

Two-phase flow pressure losses in pipeline fittings.

☐ Section 13: Non-Newtonian Flow

ESDU 97034

Non-Newtonian fluids: Guide to classification and characteristics.

ESDU 95012

Non-Newtonian fluids: obtaining viscometric data for frictional pressure loss estimation for pipe flow.

ESDU 04005

Non-Newtonian fluids: tube viscometry worked example.

ESDU 91025

Non-Newtonian fluids: frictional pressure loss prediction for fully-developed flow in straight pipes.

☐ Section 14: Fans

ESDU 79037

A guide to fan selection and performance.

☐ Section 15: Pumps

ESDU 80030

Radial, mixed, and axial flow pumps. Introduction.

ESDU 80031

Radial, mixed, and axial-flow pumps. Size estimation and specification.

ESDU 81001

Radial, mixed, and axial-flow pumps. Glossary of terms.

ESDU 81002

Radial, mixed, and axial-flow pumps. Conversion factors.

☐ Section 16: Noise in Air - Conditioning Systems

ESDU 82001

An introduction and guide to noise in ventilation, air-conditioning, and other ducting systems.

ESDU 82002

Reduction of sound in ventilation and similar air distribution systems.

ESDU 82003

Example to illustrate the use of Data Items on noise from ducted ventilation and air-conditioning systems.

ESDU 81043

Sound in low velocity ventilation ducts.

ESDU TM 180

ESDU Technical Memorandum – Modelling of ventilation for thermal comfort and indoor air quality

☐ Section 17: Fluid Transients in Pipes and Tunnels

ESDU 83046

Fluid transients in pipes and tunnels. Speed of propagation of pressure waves.

ESDU 84013

Fluid transients in pipes. Reduction and control of pressure surges in liquids.

ESDU 84038

Fluid transients in pipes. Pressure surge following pump trip in rising mains and other similar discharge lines. Suppression using air vessels.

ESDU 85009

Fluid transients in pipes. Use of air inlet/outlet valves as surge suppression devices.

ESDU 85044

Fluid transients in pipes. Pressure surge following booster pump trip. Suppression using pump bypass.

☐ Section 18: Fluid Transients

ESDU 86015

Fluid transients in pipes. Estimation of maximum pressures and forces in steam lines.

ESDU 87027

Computer program for the prediction of fluid transients in liquid-filled systems.

☐ Section 19: Pipeline Vibrations

ESDU 88022

Pipeline vibrations. Undamped natural vibration of pipelines.

ESDU 89030

Pipeline vibrations. Fluid transients in non-rigid, unbranched planar piping systems.

ESDU 93031

Pipeline vibrations. Computer program for the prediction of fluid transients in flexible, unbranched three-dimensional piping systems.

☐ Section 20: CFD Guides

ESDU CFD-BPG 09010

CFD Best Practice Guidelines for modelling friction losses and flow characteristics in straight pipes.

ESDU CFD-BMK 09011

CFD Benchmarks for predicting friction losses and flow characteristics in straight pipes.

ESDU CFD-BPG 07008

CFD Best Practice Guidelines for modelling pressure loss and flow characteristics. Incompressible flow in sudden contractions.

ESDU CFD-BMK 07009

CFD Benchmarks for predicting pressure loss and flow characteristics. Incompressible flow in sudden contractions.

ESDU CFD-BPG 11010

CFD Best Practice Guidelines for modelling pressure losses and flow characteristics in square- and knife-edged orifice plates.

Fluid Mechanics, Internal Flow (Aero)

☐ Section 1: Organizational Documents

ESDU 04021

Fluid Mechanics, Internal Flow
Series: Record of Documents.

☐ Section 2: General

ESDU CFA

Conversion factors.

ESDU FMI1

Introductory memorandum on the pressure losses in internal flow systems.

ESDU 12003

Pressure and Flow Measurements.

☐ Section 3: Compressible Flow Relationships

ESDU 67035

Jet flow parameters.

ESDU 74028

One-dimensional compressible gas flow in ducts.

ESDU 95011

One-dimensional representation of steady, spatially non-uniform flow. An equivalent mean-value set for compressible flow. Part 1. Implementation for an ideal, calorically-perfect gas.

ESDU 97029

One-dimensional representation of steady, spatially non-uniform flow. An equivalent mean-value set for compressible flow. Part 2. Implementation for an ideal, thermally-perfect gas.

ESDU 03012

Computer program for calculation of mean value properties for non-uniform compressible flows.

ESDU TM 148

ESDU TECHNICAL MEMORANDUM
The implications of flow property profiles on determination and application of non-dimensional pressure loss coefficients for flow of incompressible fluids.

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ESDU 66027

Friction losses for fully-developed flow in straight pipes.

ESDU 74029

Friction losses for fully-developed flow in straight pipes of constant cross section - subsonic compressible flow of gases.

ESDU 79014

Losses caused by friction in straight pipes with systematic roughness elements.

ESDU TN 08008

CFD studies for the validation of friction losses and flow characteristics in circular straight pipes with smooth walls.

ESDU TN 08009

CFD validation studies for transitional flow in circular straight pipes with smooth walls.

☐ Section 5: Bends, Branches and Junctions

ESDU 73022

Pressure losses in three-leg pipe junctions: dividing flows.

ESDU 73023

Pressure losses in three-leg pipe junctions: combining flows.

ESDU 83037

Pressure losses in curved ducts: single bends.

ESDU 77009

Pressure losses in curved ducts: interaction factors for two bends in series.

ESDU 77029

Pressure losses in curved ducts: coils.

☐ Section 6: Duct Fittings and Equipment

ESDU 66030

Pressure losses in flow metering devices.

ESDU 69022

Pressure losses in valves.

ESDU 72009

Pressure drop in ducts across round-wire gauzes normal to the flow.

ESDU 74040

Pressure loss during crossflow of fluids with heat transfer over plain tube banks without baffles.

ESDU 79034

Crossflow pressure loss over banks of plain tubes in square and triangular arrays including effects of flow direction.

ESDU 81021

Pressure losses caused by obstructions in ducts or pipes.

ESDU 81039

Flow of liquids. Pressure losses across orifice plates, perforated plates and thick orifice plates in ducts.

ESDU 82009

Compressible flow of gases. Pressure losses and discharge coefficients of orifice plates, perforated plates and thick orifice plates in ducts.

ESDU TN 07007

Incompressible flow through orifice plates - a review of the data in the literature.

ESDU TN 10013

CFD validation studies for incompressible flow through square-edged orifice plates.

☐ Section 7: Ejectors and Jet Pumps

ESDU 92042

Ejectors and jet pumps: computer program for design and performance for compressible gas flow.

ESDU 93022

Ejectors and jet pumps: computer program for design and performance for liquid flow.

ESDU 85032

Ejectors and jet pumps. Design and performance for incompressible liquid flow.

ESDU 86030

Ejectors and jet pumps. Design for steam driven flow.

ESDU 94046

Ejectors and jet pumps: computer program for design and performance for steam/gas flow.

☐ Section 8: Duct Expansions

ESDU 72011

Flow through a sudden enlargement of area in a duct.

ESDU 76027

Introduction to design and performance data for diffusers.

ESDU 73024

Performance of conical diffusers in incompressible flow.

ESDU 74015

Performance in incompressible flow of plane-walled diffusers with single-plane expansion.

ESDU 75026

Performance of circular annular diffusers in incompressible flow.

ESDU 87015

Performance improvement of axial diffusers for incompressible flow.

ESDU 90025

Performance of conical diffusers in subsonic compressible flow.

ESDU TM 19

ESDU TECHNICAL MEMORANDUM
Effects of truncation on diffuser performance.

☐ Section 9: Duct Contractions

ESDU 05024

Flow through sudden contractions of duct area: pressure losses and flow characteristics.

ESDU TN 06023

CFD validation studies for pressure loss and flow characteristics in sudden contractions.

☐ Section 10: Rotating Machinery

ESDU 07004

Flow in rotating components - discs, cylinders and cavities.

ESDU 09004

Labyrinth seal flow.

☐ Section 11: CFD Guides

ESDU CFD-BPG 09010

CFD Best Practice Guidelines for modelling friction losses and flow characteristics in straight pipes.

ESDU CFD-BMK 09011

CFD Benchmarks for predicting friction losses and flow characteristics in straight pipes.

ESDU CFD-BPG 07008

CFD Best Practice Guidelines for modelling pressure loss and flow characteristics. Incompressible flow in sudden contractions.

ESDU CFD-BMK 07009

CFD Benchmarks for predicting pressure loss and flow characteristics. Incompressible flow in sudden contractions.

ESDU CFD-BPG 11010

CFD Best Practice Guidelines for modelling pressure losses and flow characteristics in square- and knife-edged orifice plates.

Heat Transfer

☐ Section 1: Organizational Documents

ESDU 05009

Heat Transfer Series record of documents.

☐ Section 2: Internal Flow - Single-Phase Convection

ESDU 92003

Forced convection heat transfer in straight tubes. Part 1: turbulent flow.

ESDU 93018

Forced convection heat transfer in straight tubes. Part 2: laminar and transitional flow.

ESDU 78031

Internal forced convective heat transfer in coiled pipes.

ESDU 81044

Heat transfer coefficients for water or steam in plain circular tubes: fully-developed turbulent flow.

ESDU 81045

Forced convective heat transfer in concentric annuli with turbulent flow.

☐ Section 3: Internal Flow - Single-Phase Convection - Enhancement

ESDU 82021

Pressure loss and heat transfer for single-phase turbulent flow in roughened channels: methods of calculation.

ESDU 95027

Pressure loss and heat transfer for single phase flow in tubes containing twisted tape inserts.

☐ Section 4: External Flow - Single-Phase Convection - Single Tubes and Other Bodies

ESDU 69004

Convective heat transfer during forced crossflow of fluids over a circular cylinder including free convection effects.

ESDU 77031

Heat transfer by free convection and radiation - simply shaped bodies in air and other fluids.

☐ Section 5: External Flow - Single-Phase Convection - Tube Banks and Shell-And-Tube Heat Exchangers

ESDU 73031

Convective heat transfer during crossflow of fluids over plain tube banks.

ESDU 84016

Low-fin staggered tube banks: heat transfer and pressure loss for turbulent single-phase crossflow.

ESDU 86022

High-fin staggered tube banks: heat transfer and pressure drop for turbulent single phase gas flow.

ESDU 83038

Baffled shell-and-tube heat exchangers; flow distribution, pressure drop and heat transfer coefficient on the shell side.

☐ Section 6: Heat Pipes

ESDU 80013

Heat pipes - general information on their use, operation, and design.

ESDU 79012

Heat pipes - performance of capillary-driven designs.

ESDU 79013

Heat pipes - properties of common small-pore wicks.

ESDU 80017

Thermophysical properties of heat pipe working fluids:
operating range between -60 degrees C and 300 degrees C.

ESDU 81038

Heat pipes - performance of two-phase closed thermosyphons.

☐ Section 7: Insulation

ESDU 80041

A guide to the thermal and mechanical characteristics of refractory lining materials.

☐ Section 8: Temperature Measurement

ESDU 02006

Temperature measurement: techniques.

ESDU 06018

Temperature measurement: thermocouples.

ESDU 06019

Temperature measurement: resistance thermometry.

☐ Section 9: Evaporation

ESDU 85041

Boiling inside tubes: general aspects and saturated wet-wall heat transfer.

ESDU 91011

Boiling inside tubes: saturated wet-wall heat transfer with mixtures.

ESDU 86032

Boiling inside tubes: critical heat flux for upward flow in uniformly heated vertical tubes.

ESDU 88001

Boiling inside tubes: critical heat flux for flow in uniformly heated horizontal tubes.

ESDU 89036

Boiling inside tubes: pressure drop in straight tubes with upward or horizontal flow.

ESDU 90001

Boiling inside tubes: post dry-out heat transfer in vertical tubes.

ESDU 98010

Falling film evaporation in vertical tubes.

☐ Section 10: Condensation

ESDU 85022

Practical guide to the selection of condensers.

ESDU 84023

Shell-and-tube exchangers: pressure drop and heat transfer in shellside downflow condensation.

ESDU 01009

Condensation of pure fluids in downflow on horizontal integral low-fin tube bundles.

ESDU 90024

Condensation inside tubes: pressure drop in straight tubes with vertical downflow.

ESDU 91023

Condensation inside tubes: pressure drop in straight horizontal tubes.

ESDU 91024

Condensation inside tubes: condensate film coefficient for vertical downflow.

ESDU 94041

Condensation inside tubes: condensate film coefficient in horizontal tubes.

ESDU 89038

Reflux condensation in vertical tubes.

☐ Section 11: Fouling

ESDU 86038

Fouling of heat exchanger surfaces: general principles.

ESDU 00016

Heat exchanger fouling in the pre-heat train of a crude oil distillation unit.

ESDU 08002

Fouling in cooling systems using fresh water.

ESDU 03004

Fouling in cooling systems using seawater.

ESDU 88024

Fouling in cooling water systems.

☐ Section 12: Fouling and Slagging

ESDU 92012

Fouling and slagging in combustion plant.

☐ Section 13: Process Integration

ESDU 87030

Process integration.

ESDU 89001

Application of process integration to utilities, combined heat and power and heat pumps.

ESDU 90033

Process integration: process change and batch processes.

☐ Section 14: Heat Exchangers - Flow Induced Vibration

ESDU 87019

Flow induced vibration in tube bundles with particular reference to shell and tube heat exchangers.

ESDU 88028

Flow induced acoustic resonance in tubular heat exchangers.

☐ Section 15: Heat Exchangers - Effectiveness - NTU Relationships

ESDU 98003

Design and performance evaluation of heat exchangers: the effectiveness-NTU method. Part 1: introduction.

ESDU 98004

Design and performance evaluation of heat exchangers: the effectiveness-NTU method. Part 2: performance comparisons and selection of configurations presented in Part 3.

ESDU 98005

Design and performance evaluation of heat exchangers: the effectiveness-NTU method. Part 3: graphical and analytical data.

ESDU 98006

Design and performance evaluation of heat exchangers: the effectiveness-NTU method. Part 4: case studies.

ESDU 98007

Design and performance evaluation of heat exchangers: the effectiveness-NTU method. Part 5: analytical techniques.

☐ Section 16: Heat Exchangers - Selection and Costing

ESDU 92013

Selection and costing of heat exchangers.

ESDU 94042

Selection and costing of heat exchangers. Shell-and-tube type.

ESDU 94043

Selection and costing of heat exchangers. Air-cooled type.

ESDU 95007

Selection and costing of heat exchangers: plate-and-frame type.

ESDU 97006

Selection and costing of heat exchangers. Plate-fin type.

☐ Section 17: Heat Exchangers - Rapid Design

ESDU 97007

Heat transfer enhancement in heat exchanger design and utilization. Part 1. Tube inserts in single-phase flow.

☐ Section 18: Cooling Systems

ESDU 13004

Selection of Cooling Systems.

Mechanism

☐ Section 1: Organizational Documents

ESDU 00004

Mechanisms Series record of documents.

☐ Section 2: General

ESDU 02007

AMOPS: computer program for the calculation of area and moments of area of planar shapes.

ESDU TM 119

ESDU TECHNICAL MEMORANDUM
Calculation of planar area and moment properties - theoretical background

ESDU 03010

Timing diagrams and their use in mechanism design.

Section 3: Gears

ESDU 68040

Design of parallel axis straight spur and helical gears - choice of materials and preliminary estimate of major dimensions.

ESDU 77002

Design of parallel axis straight spur and helical gears:
geometric design.

ESDU 83021

The kinematic design of epicyclic gear trains.

ESDU 88033

The design of spur and helical involute gears. A procedure compatible with BS 436: Part 3: 1986 - method for calculation of contact and root bending stress limitations for metallic involute gears.

Section 4: Contact Stresses

ESDU 78035

Contact phenomena. I: stresses, deflections, and contact dimensions for normally-loaded unlubricated elastic components.

ESDU 84017

Contact phenomena. II: stress fields and failure criteria in concentrated elastic contacts under combined normal and tangential loading.

ESDU 85007

Contact phenomena. III: calculation of individual stress components in concentrated elastic contacts under combined normal and tangential loading.

ESDU 94034

Dimensions, deflections, and stresses for Hertzian contacts under combined normal and tangential loading. (Guide to use of computer program A9434.)

Section 5: Cams - Guide to Data Items

ESDU 01002

Guide to the use of ESDU Data Items on cam design.

Section 6: Cams - Calculation Methods

ESDU 95001

Kinematic analysis of disc cams.

ESDU 00013

OSCAM. Computer-aided cam design: installation.

ESDU 00014

OSCAM. Computer-aided cam design: user manual.

Section 7: Cams - Derivation of Equations

ESDU ME2

Design of disc cams with various followers: derivation of kinematic equations.

Section 8: Cams - Estimation of Basic Dimensions

ESDU 82023

The estimation of basic dimensions of disc cams with translating followers.

ESDU 83008

The estimation of basic dimensions of disc cams with swinging followers.

ESDU 92005

Minimum size of disc cams with radial translating roller followers.

Section 9: Cams - Examples

ESDU 85013

Design of disc cams and their followers: examples.

Section 10: Cams - Cam Law Blending

ESDU 83027

The synthesis of cam motion by blending segments.

ESDU 86026

Introduction to polynomial cam laws.

ESDU 92014

Blending profiles of disc cams with radial translating roller followers. Part 1: to reduce segment angle, reduce reference circle radius or increase follower lift.

ESDU 93002

Blending profiles of disc cams with radial translating roller followers. Part 2: to incorporate an intermediate precision point or a constant velocity component.

Section 11: Cams - Material Selection

ESDU 94017

Selection of materials, manufacturing methods and lubricants for cam mechanisms.

Section 12: Cams - Stress and Lubrication Analysis

ESDU 91026

Analysis of cam roller followers.

ESDU 93001

Contact stress in disc cams with roller followers.

ESDU 94008

Lubricant film thickness between disc cams and followers.

ESDU 94011

Contact stress in disc cams with domed or flat faced followers.

ESDU TM 101

ESDU TECHNICAL MEMORANDUM
Derivation of lubricant entrainment velocity for disc cams with six different types of follower.

ESDU TM 102

ESDU TECHNICAL MEMORANDUM
Derivation of contact force and radius of curvature of cam profile for disc cams with six different types of follower.

☐ Section 13: Cams - Selection

ESDU 82006

Selection of DRD cam laws.

ESDU 82024

A guide to the selection of cam and follower type.

ESDU 06002

Dwell-Rise-Fall-Dwell and Dwell-Fall-Rise-Dwell cam laws. Sections 1 to 8: segments having equal rise and fall periods.

ESDU 06003

Dwell-Rise-Fall-Dwell and Dwell-Fall-Rise-Dwell cam laws. Sections 9 to 13: segments having asymmetric rise and fall periods.

ESDU 06004

Dwell-Rise-Fall-Dwell and Dwell-Fall-Rise-Dwell cam laws. Sections 14 to 23: examples.

ESDU 06005

Dwell-rise-fall-dwell cam laws.
Computer program.

☐ Section 14: Linkages - Atlas of Performance Curves

ESDU 81033

Atlas of performance curves for crank-rocker and slider-crank linkages.

☐ Section 15: Linkages - Synthesis and Analysis

ESDU ME1

Guide to the use of Item No. 76005. Kinematic and dynamic data for crank-rocker and slider-crank linkages.

ESDU 90022

Force analysis of planar linkages.

ESDU 10019

Effect of link length tolerances on the performance of four-bar linkages

☐ Section 16: Workbench

ESDU ME1

Guide to the use of Item No. 76005. Kinematic and dynamic data for crank-rocker and slider-crank linkages.

ESDU 76005

Kinematic and dynamic data for crank-rocker and slider-crank linkages. (Mechanisms Workbench.)

☐ Section 17: Linkages - Balancing

ESDU 89028

A procedure for force-balancing planar linkages using counterweights.

ESDU 89043

A comparison of techniques for balancing planar linkages.

ESDU 90007

Procedures for balancing planar linkages using rotating counterweights.

ESDU 92016

Reducing torque fluctuation in linkage drive shafts.

☐ Section 18: Geneva Mechanisms

ESDU ME3

Analysis of Geneva mechanisms: derivation of kinematic and kinetostatic equations.

ESDU 96002

Geneva mechanisms. Part 1: design.

ESDU 96011

Geneva mechanisms. Part 2: computer program.

ESDU 96035

Geneva mechanisms. Part 3: examples.

ESDU 99001

Geneva mechanisms. Part 4: advanced examples.

☐ Section 19: OSMEC - Linkage Analysis Software

ESDU 97023

OSMEC. Computer-aided linkage design: installation.

ESDU 97026

OSMEC. Computer-aided linkage design: User manual.

ESDU 98023

OSMEC. Computer mechanism design: basic examples.

☐ Section 20: Springs

ESDU 06024

Dynamic characteristics of cylindrical helical springs. Part 1: deformation, stresses, and stability.

ESDU 08015

Dynamic characteristics of cylindrical helical springs.
Part 2: vibration

ESDU 09003

Dynamic characteristics of cylindrical helical springs. Part 3: impact loading on compression springs.

Performance

☐ Section 1: Explanatory and General Guidance

ESDU 99035

Performance Series record of documents.

ESDU Notation and Units

Notation and units in Performance Data Items.

ESDU CFA

Conversion factors.

ESDU 80009

The use of Data Items on aircraft performance measurement.

ESDU 80026

The use of Data Items on aircraft performance estimation.

ESDU 04008

Use of Carpet Plots to represent functions of two variables.

ESDU 04012

Examples of construction of carpet plots from experimental data.

☐ Section 2: Equations of Motion

ESDU 78038

Introduction to equations of motion for performance.

ESDU 80032

Simplified forms of performance equations.

ESDU 86004

Simplified forms of performance equations. Addendum A: effect on aeroplane level speed of small changes in thrust, drag, weight, power.

ESDU 92019

Estimation of rate of climb.

ESDU 94039

Effects of small changes on rate of climb.

ESDU 81046

Acceleration factors for climb and descent rates at constant EAS, CAS, and M.

ESDU 94040

Effects of cabin pressure on climb and descent rates.

☐ Section 3: Atmospheric Data

ESDU 68046

Atmospheric data for performance calculations.

ESDU 72018

Atmospheric data for performance calculations. Addendum: height in feet, data in SI units.

ESDU 77022

Equations for calculation of International Standard Atmosphere and associated off-standard atmospheres.

ESDU 78012

Height relationships for non-standard atmospheres.

☐ Section 4: Airspeed Data

ESDU 69026

Airspeed data for performance calculations.

☐ Section 5: Drag of Airframes

ESDU 81026

Representation of drag in aircraft performance calculations (with Addenda A to G).

ESDU 97016

Estimation of airframe drag by summation of components: principles and examples.

ESDU 94044

Excrescence drag levels on aircraft.

ESDU 88006

Estimation of drag arising from asymmetry in thrust or airframe configuration.

☐ Section 6: Drag of Engines

ESDU 84005

Estimation of drag due to inoperative turbo-jet and turbo-fan engines using Data Item Nos 81009 and 84004.

ESDU 81009

Estimation of windmilling drag and airflow of turbo-jet and turbo-fan engines.

ESDU 84004

Estimation of spillage drag for a wide range of axisymmetric intakes at M less than 1.

☐ Section 7: Estimation - Jet and Fan Engine Thrust

ESDU 76034

Estimation of take-off thrust using generalized data for turbo-jet and turbo-fan engines.

ESDU 77001

Effect of intake total pressure loss on net thrust at take-off: turbo-jet and turbo-fan engines.

☐ Section 8: Estimation - Propellers

ESDU 83001

Approximate parametric method for propeller thrust estimation.

ESDU 83028

Approximate parametric method for propeller thrust estimation. Addendum A: application to fixed-pitch propellers.

ESDU PERF ED1/1

Approximate estimation of drag of windmilling propellers.

ESDU PERF ED1/2

Approximate estimation of braking thrust of propellers (piston engines).

☐ Section 9a: Tyre-Runway Forces - Mathematical Models for Calculating Forces

ESDU 16008

Frictional and retarding forces on aircraft tyres - Introduction to the ESDU methods.

ESDU 15002

Definitions for runway contaminants and the classification and distribution of hard runway surfaces.

ESDU 05011

Summary of the model for performance of an aircraft tyre rolling or braking on dry or precipitate contaminated runways.

ESDU 10015

Model for performance of a single aircraft tyre rolling or braking on dry and precipitate contaminated runways.

ESDU 13007

Side-force coefficients on aircraft tyres in yawed and unbraked motion on dry and wet pavements.

ESDU 11004

Decelerating forces on multiple-wheel undercarriages rolling or braking on precipitate contaminated runways.

ESDU 23001

Introduction to ESDU tyre-runway modelling

ESDU 23002

Tyre braking on dry or water-covered runways - summary of ESDU tyre-runway modelling

ESDU 23003

Static braking-force coefficients for tyres on wet and dry surfaces

ESDU 23004

Tyre skidding on dry, paved surfaces

ESDU 23005

Tyre slipping on dry, paved surfaces

ESDU 23006

Tyre skidding on wet, paved surfaces

ESDU 23007

Tyre slipping on wet, paved surfaces

ESDU 23008

Decelerating forces on tyres moving through water or slush

☐ Section 9b: Tyre-Runway Forces - Worked Examples

ESDU 10002

Introduction to worked examples of tyres rolling or braking on dry or precipitate contaminated runways. Application of ESDU 05011 and ESDU 13007.

ESDU 10003

Worked example for tyre in linear motion on a contaminated runway surface. Application of ESDU 05011.

ESDU 10004

Worked example of ground-test machine operating on a dry or contaminated runway surface. Application of ESDU 05011.

ESDU 15008

Tyre in linear motion on a runway covered by various forms of loose snow. An application of ESDU 05011.

ESDU 15007

Worked example for tyre in yawed motion on a dry or wet runway surface. An application of ESDU 13007.

ESDU 13002

Worked example for aircraft with multiple-wheel undercarriages braking on water-covered runway. Application of ESDU 11004.

ESDU 23009

Aircraft braking on dry runway

☐ Section 9c: Tyre-Runway Forces - Development of Models

ESDU TM 151

ESDU TECHNICAL MEMORANDUM
Stresses in the tread material of an unloaded inflated tyre.

ESDU TM 161

ESDU TECHNICAL MEMORANDUM
Calculation of coefficients of rolling, braking and yawed rolling resistance.

ESDU TM 174

ESDU TECHNICAL MEMORANDUM
Correlation of the micro-texture sharpness parameter F1.

ESDU TM 176

ESDU TECHNICAL MEMORANDUM
Effective phase angle in tyre-friction modelling.

ESDU TM 191

ESDU TECHNICAL MEMORANDUM
Rebound resilience of interface layer - effect of temperature and bearing pressure

ESDU TM 196

ESDU TECHNICAL MEMORANDUM
Asphalt pavement surfaces - Surface temperature and decelerating forces

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ESDU TECHNICAL MEMORANDUM
British Pendulum - use in modelling decelerating-force coefficients

ESDU TM 202

ESDU TECHNICAL MEMORANDUM
ESDU Tyre modelling - rubber-block forces

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ESDU TECHNICAL MEMORANDUM
British Pendulum - illustration of ESDU models

ESDU TM 204

ESDU TECHNICAL MEMORANDUM
Hysteresis and adhesion - an algebraic model deduced from output from a British Pendulum

ESDU TM 205

ESDU TECHNICAL MEMORANDUM
Rubber blocks at high pressure

ESDU TM 211

ESDU TECHNICAL MEMORANDUM
Pressures under wet footprint.

ESDU TM 212

ESDU TECHNICAL MEMORANDUM
Rigidity modulus for interface material in wet conditions

☐ Section 10: Tyre Spray

ESDU 83042

Estimation of spray patterns generated from the sides of aircraft tyres running in water or slush.

ESDU 98001

Estimation of airframe skin-friction drag due to impingement of tyre spray.

☐ Section 11: Airfield Performance - General

ESDU 85029

Calculation of ground performance in take-off and landing.

ESDU 85030

Force and moment components for take-off and landing calculations.

ESDU 99015

Statistical analysis of wet runway friction for aircraft and ground-test machines.

ESDU 99016

Example of statistical analysis of wet runway friction: aircraft with extensive set of test data.

ESDU 99017

Example of statistical analysis of wet runway friction: aircraft with limited set of test data.

ESDU 00018

Example of statistical analysis of wet runway friction: ground-test machine data.

ESDU 08014

Guide to contaminated runway testing.

ESDU TM 95

ESDU TECHNICAL MEMORANDUM
Impact forces resulting from wheel generated spray: a re-assessment of existing data.

ESDU TM 96

ESDU TECHNICAL MEMORANDUM
Operations on surfaces covered with slush.

ESDU PERF RG2/1

Reduction of take-off and landing measurements to standard conditions.

☐ Section 12a: Contaminated Runways - Operations

ESDU 08014

Guide to contaminated runway testing.

ESDU 15003

Planing of rib-tread aircraft tyres.

ESDU 19005

Accumulation of water on runway.

ESDU TM 96

ESDU TECHNICAL MEMORANDUM
Operations on surfaces covered with slush.

☐ Section 12b: Contaminated Runways - Application of Methods

ESDU 15009

Determination of hydroplaning speeds and corresponding hydrodynamic forces for rib tread aircraft tyres. Application of ESDU 15003.

ESDU TM 165

ESDU TECHNICAL MEMORANDUM
Analysis of ground-rolling tests through water with a Canberra aircraft.

ESDU TM 192

ESDU TECHNICAL MEMORANDUM
Analysis of aircraft tests on flooded runways: an empirical approach.

ESDU TM 167

ESDU TECHNICAL MEMORANDUM
Mumeter Mk 6: a continuous friction measuring device. Evaluation on test surfaces at Nantes.

ESDU TM 170

ESDU TECHNICAL MEMORANDUM
Falcon 20: rolling on dry and snow-covered surfaces.

☐ Section 12c: Contaminated Runways - Statistical Analysis of Wet Runway Data

ESDU 99015

Statistical analysis of wet runway friction for aircraft and ground-test machines.

ESDU 99016

Example of statistical analysis of wet runway friction:
aircraft with extensive set of test data.

ESDU 99017

Example of statistical analysis of wet runway friction:
aircraft with limited set of test data.

ESDU 00018

Example of statistical analysis of wet runway friction:
ground-test machine data.

☐ Section 13: Landing

ESDU 84040

First approximation to landing field length for civil transport aeroplanes (50 ft, 15.24 m screen).

ESDU 91032

Estimation of airborne performance in landing.

ESDU 92020

Energy method for analysis of measured airspeed change in landing airborne maneuver.

ESDU PERF EG6/2

Estimation of approach speed.

ESDU PERF EG6/4

☐ Estimation of ground run during landing.

Section 14: Estimation - Take-off

ESDU PERF EG5/1

Estimation of take-off distance.

ESDU 76011

First approximation to take-off field length of multi-engined transport aeroplanes.

ESDU 82033

First approximation to take-off distance to 50 ft (15.2 m) for light and general aviation aeroplanes.

ESDU 87018

Example of take-off field length calculations for a civil transport aeroplane.

ESDU 87037

☐ Take-off performance of vectored-jet-thrust V/STOL aircraft.

Section 15: Estimation - Range and Endurance

ESDU 73018

Introduction to estimation of range and endurance.

ESDU 73019

Approximate methods for estimation of cruise range and endurance: aeroplanes with turbo-jet and turbo-fan engines.

ESDU 74018

Lost range, fuel, and time due to climb and descent: aircraft with turbo-jet and turbo-fan engines.

ESDU 74041

Example of the use of Data Items on range performance.

ESDU 75018

Estimation of cruise range: propeller-driven aircraft.

ESDU 77015

Lost range, fuel, and time due to climb and

☐ descent: propeller-driven aeroplanes.

Section 16: Flight Path Optimization

ESDU 89015

Introduction to Data Items on flight path optimization.

ESDU 90012

Energy height method for flight path optimization.

ESDU 91016

Energy height method for flight path optimization. Addendum A: numerical method suitable for rapid use on IBM PC compatible computers.

ESDU 93021

Examples of flight path optimization using a multivariate gradient-search method.

ESDU 94016

Examples of flight path optimization using a multivariate gradient-search method. Addendum A: variation of optimum flight profile parameters with range.

ESDU 94012

☐ Application of multivariate optimization techniques to determination of optimum flight trajectories.

Section 17: Estimation - Manoeuvres

ESDU PERF EG8/1

Estimation of turning performance.

ESDU PERF EG8/2

☐ Estimation of rolling manoeuvrability.

Section 18: Statistical Techniques

ESDU 91017

Statistical methods applicable to analysis of aircraft performance data.

ESDU 91018

Example of statistical techniques applied to cruise performance guarantees (Student's "t" distribution).

ESDU 91019

Example of statistical techniques applied to autoland touchdown dispersion (confidence intervals for normal and skew distributions).

ESDU 91020

Variability of standard aircraft

performance parameters.

ESDU 92021

Example of statistical techniques applied to analysis of landing ground roll distance measurements. (Linear regression, correlation coefficient, and F test.)

ESDU 92022

Example of statistical techniques applied to analysis of measurements of the landing airborne maneuver. (Multiple linear regression with two independent variables and one dependent variable.)

ESDU 93023

Example of statistical techniques applied to analysis of effects of small changes.

ESDU 96024

Example of statistical techniques applied to analysis of paved runway sizes (Bivariate Normal Distribution).

Section 19: Similarity Methods

ESDU 97025

Similarity rules for application in aircraft performance work.

ESDU 98026

Example of similarity methods applied to base drag coefficient of conical afterbodies in axisymmetric flow (jet off).

ESDU 08010

Example of similarity methods applied to aircraft drag data from flight test.

Section 20: Fitting of Functions

ESDU 01011

Compendium of curves and approximating algebraic functions.

ESDU 06025

Guide to linear Least Squares curve fitting techniques.

Analysis of tests on a convergent nozzle in an altitude test facility.

Section 21: Air Data - Flight Test Measurement

ESDU 86031

Introduction to air data system parameters, errors, and calibration laws.

ESDU 83029

The correction of flight-test anemometric data.

ESDU 88025

Derivation of primary air-data parameters for hypersonic flight.

ESDU 93020

Computation of static pressure downstream of a normal shock for hypersonic flight (ambient temperature known).

Section 22: Air Data - Sensor Calibrations and Errors

ESDU 86006

Pitot and static errors in steady level flight.

Section 23: Thrust Determination

ESDU 69006

Introduction to the measurement of thrust in flight. (Air breathing ducted-flow engines.)

ESDU 69007

The determination of gross thrust and mass flow in flight. (Air breathing ducted-flow engines with convergent nozzles.)

ESDU 69008

Curves for use in the determination of gross thrust and mass flow in flight. (Air breathing ducted-flow engines with convergent nozzles.)

Section 24: Analysis - Jet Aeroplanes

ESDU 70020

Non-dimensional approach to engine thrust and airframe drag for the analysis of measured performance data: aircraft with turbo-jet and turbo-fan engines.

ESDU 70021

Graphical method for the analysis of measured performance data using drag determination: aircraft with turbo-jet and turbo-fan engines.

ESDU 70022

Non-dimensional graphical method for the analysis of measurements of steady level speed, range, and endurance: aircraft with turbo-jet and turbo-fan engines.

ESDU 70023

The measurement and analysis of climb and excess power performance.

ESDU PERF RJ1/2

Performance analysis for aircraft with turbo-jets. "Non-dimensional" graphical method. Rate of climb.

ESDU 79018

Example of performance analysis using data obtained concurrently in air-path, body, and Earth axes.

ESDU 15001

Aircraft performance from flight test. Part 1: derivation of a mathematical model.

ESDU 16003

Aircraft performance from flight test. Part 2: thrust-drag accounting

ESDU 17013

Aircraft performance from flight test. Part 3: in-flight calibration of an angle of attack sensor.

ESDU TM 185

Air data calibration using a GPS/INS (EGI).

ESDU TM 189

Analysis of tests on a convergent nozzle in an altitude test facility.

ESDU TM 190

ESDU TECHNICAL MEMORANDUM
Aircraft Performance from flight test: An example of the use of maneuvering flight.

ESDU TM 199

Aircraft Performance from Flight Test. Derivations applicable to ESDU 2007 on the GPS methods for determining true airspeed and wind speeds.

ESDU 20007

Part 4: Calibration of pressure air data systems, Sub-part II: GPS methods for determining true airspeed and wind speeds.

☐ Section 25: Reduction Methods - Aeroplanes

ESDU PERF RJ2/0

Introductory sheet on the analytical method of performance reduction for aircraft with turbo-jets.

ESDU PERF RJ2/1

Analytical method of performance reduction for aircraft with turbo-jets. Rate of climb.

ESDU PERF RT1/0

Performance reduction for aircraft with turbo-props. "Non-dimensional" graphical method.

ESDU PERF RT1/1

Performance reduction for aircraft with turbo-props. "Non-dimensional" graphical method. Level speed.

ESDU PERF RT1/2

Performance reduction for aircraft with turbo-props. "Non-dimensional" graphical method. Rate of climb.

ESDU PERF RT1/3

Performance reduction for aircraft with turbo-props. "Non-dimensional" graphical method. Range and endurance.

ESDU PERF RP1/0

Standard British method of performance reduction for piston-engined aircraft with constant-speed propellers.

ESDU PERF RP1/1

Standard British method of performance reduction for piston-engined aircraft with constant-speed propellers. Level speed.

ESDU PERF RP1/2

Standard British method of performance reduction for piston-engined aircraft with constant-speed propellers. Rate of climb.

ESDU PERF RP1/3

Standard British method of performance reduction for piston-engined aircraft with constant-speed propellers. Fuel consumption.

ESDU PERF RP2/0

General method of performance reduction for piston-engined aircraft with constant-speed propellers.

☐ Section 26: Analysis - Turbine Helicopters

ESDU 73026

Introduction to non-dimensional methods for the measurement of performance of turbine-engined helicopters.

ESDU 73027

Non-dimensional methods for the measurement of hover performance of turbine-engined helicopters.

ESDU 74042

Non-dimensional methods for the measurement of level-flight performance of turbine-engined helicopters.

ESDU 20006

Aircraft performance from flight test.
Part 4: Calibration of pressure air data systems, Sub-part i: subsonic flight.

☐ Section 27: Aircraft Performance Program

ESDU 00031

Aircraft Performance Program.
Part 1: Introduction to the computer programs for aircraft performance evaluation.

ESDU 00032

Aircraft performance program. Part 2: installing and running Programs APP02 and APP03.

ESDU 00033

Aircraft performance program. Part 3: brief guide. Programs APP02, APP03.

ESDU 00034

Aircraft performance program. Part 4: Brief form of input and output. Programs APP02 and APP03.

ESDU 00035

Aircraft performance program.
Part 5: detailed input and output. Program APP02.

ESDU 00036

Aircraft performance program. Part 6: examples of application. Programs APP02 and APP03.

ESDU 00037

Aircraft performance program.
Part 7: Error messages. Programs APP02 and APP03.

ESDU 00038

Aircraft performance program.
Part 8: description of APP02.

ESDU 00039

Aircraft Performance Program.
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☐ Section 28: Risk - Treatment and Analysis

ESDU 08003

Treatment of risk within commercial air transport.

ESDU 08004

Example of risk analysis applied to en-route flight path for large jet transport aircraft.

ESDU 08005

Example of risk analysis applied to aircraft landing distance.

ESDU 08006

Example of risk analysis for an aircraft subject to performance errors.

Physical Data, Chemical Engineering

☐ Section 1: Solar Heating

ESDU 69015

Solar heating. Total direct irradiance within the Earth's atmosphere.

☐ Section 2: Data Sources

ESDU 87009

Reliable data sources for key industrial chemicals.

☐ Section 3: Normal Melting, Boiling and Critical Points

ESDU 87028

Melting points, boiling points, and critical properties.

ESDU 71001

Normal melting points, boiling points, and critical points of n-alkyl esters of monobasic n-alkanoic acids.

ESDU 71021

Normal melting points, boiling points, and critical points of branched chain esters of monobasic alkanoic acids.

ESDU 71023

Normal melting points, boiling points, and critical points of n-alkyl aldehydes and ketones.

ESDU 72006

Normal melting points, boiling points, and critical points of monobasic alkanoic acids.

☐ Section 4: Vapour Pressure - General

ESDU PD MEMO 0301

The evaluation of vapor-pressure data.

ESDU PD1

The evaluation of Chebyshev series used for the representation of vapor pressures.

ESDU 80016

Vapour pressures and critical points of liquids. Introduction to Data Items issued after July 1980.

ESDU 84021

Vapour pressures and critical points of liquids. Introduction to Data Items issued after September 1984.

☐ Section 5: Vapour Pressure - Aliphatic Hydrocarbons

ESDU 84022

Vapour pressures and critical points of liquids. Part 1A: C1 to C7 alkanes.

ESDU 84028

Vapour pressures and critical points of liquids. Part 1B: C8 and C9 alkanes.

ESDU 85002

Vapour pressures and critical points of liquids. Part 1C: C10 to C24 alkanes.

ESDU 85008

Vapour pressures and critical points of liquids. Part 2A: C2 to C6 alkenes.

ESDU 85016

Vapour pressures and critical points of liquids. Part 2B: C7 to C16 alkenes.

ESDU 86001

Vapour pressures and critical points of liquids. Part 2C: alkadienes and alkynes.

☐ Section 6: Vapour Pressure - Aromatic Hydrocarbons

ESDU 86012

Vapour pressure and critical points of liquids. Part 3A: C6 to C10 alkylbenzenes.

ESDU 86027

Vapour pressure and critical points of liquids. Part 3B: additional alkyl- and alkenylbenzenes.

ESDU 78011

Vapour pressures and critical points of liquids. XII: aromatic nitrogen compounds.

ESDU 81025

Vapour pressures and critical points of liquids. XIX: phenol and derivatives.

ESDU 81042

Vapour pressures and critical points of liquids. XX: additional derivatives of phenol.

☐ Section 7: Vapour Pressure - Cyclo Compounds

ESDU 82016

Vapour pressures and critical points of liquids. XXI: cyclic hydrocarbons.

ESDU 77019

Vapour pressures and critical points of liquids. XI: heterocyclic nitrogen compounds.

☐ Section 8: Vapour Pressure - Organic Compounds Containing Oxygen

ESDU 88005

Vapour pressures and critical points of liquids. C1 to C6 alkanols.

ESDU 88012

Vapour pressures and critical points of liquids. C7 to C20 alkanols.

ESDU 93009

Vapour pressures and critical points of liquids: Aliphatic and cyclic ketones.

ESDU 80029

Vapour pressures and critical points of liquids. XVII: aliphatic carboxylic acids and anhydrides.

ESDU 81003

Vapour pressures and critical points of liquids. XVIII: additional esters of aliphatic carboxylic acids.

ESDU 88017

Vapour pressures and critical points of liquids: Organic oxygen compounds.

ESDU 95016

Vapour pressures and critical points of liquids. Aliphatic and aromatic ethers.

ESDU 95002

Vapour pressures and critical points of liquids. Glycols and cyclic diols.

ESDU 95004

Vapour pressures and critical points of liquids: Glycol ethers (alkyl cellosolves and carbitols etc.)

ESDU 96016

Vapour pressures and critical points of liquids. Esters of monobasic acids. 1: straight chain alkyl alkanoates.

ESDU 96021

Vapour pressures and critical points of liquids. Esters of monobasic acids. 2: branched chain alkyl alkanoates.

☐ Section 9: Vapour Pressure - Aliphatic Compounds Containing Nitrogen

ESDU 97012

Vapour pressures and critical points of liquids. Aliphatic and alicyclic amines. I: Primary amines.

ESDU 97014

Vapour pressures and critical points of liquids. Aliphatic and alicyclic amines. II: Secondary and tertiary amines.

ESDU 91035

Vapour pressures and critical points of liquids. Alkyl amides.

ESDU 79030

Vapour pressures and critical points of liquids. XIV: aliphatic oxygen-nitrogen compounds.

ESDU 80001

Vapour pressures and critical points of liquids. XV: aliphatic nitrogen compounds.

☐ Section 10: Vapour Pressure - Halogenated Aliphatic Hydrocarbons

ESDU 90015

Vapour pressures and critical points of liquids. Halogenated methanes.

ESDU 90019

Vapour pressures and critical points of liquids. Halogenated ethanes.

ESDU 91006

Vapour pressures and critical points of liquids. Halogenated ethylenes.

ESDU 89006

Vapour pressures and critical points of liquids: Halogenated C3 and higher hydrocarbons.

☐ Section 11: Vapour Pressure - Halogenated Aromatic Hydrocarbons

ESDU 98014

Vapour pressures and critical points of liquids: Halogenated benzenes.

ESDU 99007

Vapour pressures and critical points of liquids: Halogenated alkylbenzenes and halogenated styrenes.

☐ Section 12: Vapour Pressure - Organic Sulphur Compounds

ESDU 78034

Vapour pressures and critical points of liquids. XIII: organic sulphur compounds.

☐ Section 13: Vapour Pressure - Polycyclic Compounds

ESDU 93028

Vapour pressures and critical points of liquids. Fused ring compounds.

ESDU 94001

Vapour pressures and critical points of liquids. Polycyclic phenyl and cyclohexyl compounds.

☐ Section 14: Orthobaric Densities and Molar Volumes of Liquids

ESDU 89018

Orthobaric densities and molar volumes of liquids. Introduction to Data Items issued after July 1989.

ESDU 87010

Orthobaric densities and molar volumes of liquids. Part 1A: C1 to C18 alkanes.

ESDU 87017

Orthobaric densities and molar volumes of liquids. Part 2A: C2 to C16 alkenes.

ESDU 87022

Orthobaric densities and molar volumes of liquids. Part 2B: alkadienes and alkynes.

ESDU 89019

Orthobaric densities and molar volumes of liquids. Aromatic hydrocarbons.

☐ Section 15: Density - Halogenated Aliphatic Hydrocarbons

ESDU 91034

Orthobaric densities and molar volumes of liquids. Halogenated methanes.

ESDU 92009

Orthobaric densities and molar volumes of liquids: Halogenated ethanes.

ESDU 92018

Orthobaric densities and molar volumes of liquids. Halogenated ethylenes.

☐ Section 16: Density - Halogenated Aromatic Hydrocarbons

ESDU 98015

Orthobaric densities and molar volumes of liquids. Halogenated benzenes.

ESDU 99008

Orthobaric densities and molar volumes of liquids. Halogenated alkylbenzenes and halogenated styrenes.

☐ Section 17: Density - Organic Compounds Containing Oxygen

ESDU 95017

Orthobaric densities and molar volumes of liquids. Aliphatic and aromatic ethers.

ESDU 89037

Orthobaric densities and molar volumes of liquids. Alcohols.

ESDU 93010

Orthobaric densities and molar volumes of liquids. Aliphatic and cyclic ketones.

ESDU 95003

Orthobaric densities and molar volumes of liquids. Glycols and cyclic diols.

ESDU 95005

Orthobaric densities and molar volumes of liquids. Glycol ethers (alkyl cellosolves and carbitols etc.).

ESDU 96017

Orthobaric densities and molar volumes of liquids. Esters of monobasic acids. 1: straight chain alkyl alkanoates.

ESDU 96022

Orthobaric densities and molar volumes of liquids. Esters of monobasic acids. 2: branched chain alkyl alkanoates.

☐ Section 18: Density - Organic Compounds Containing Nitrogen, Polycyclic Compounds

ESDU 97013

Orthobaric densities and molar volumes of liquids. Aliphatic and alicyclic amines. I: Primary amines.

ESDU 97015

Orthobaric densities and molar volumes of liquids. Aliphatic and alicyclic amines. II: Secondary and tertiary amines.

ESDU 93029

Orthobaric densities and molar volumes of liquids. Fused ring compounds.

ESDU 94002

Orthobaric densities and molar volumes of liquids. Polycyclic phenyl and cyclohexyl compounds.

☐ Section 19: Heat Capacity and Enthalpy of Liquids

ESDU 86007

Heat capacity and enthalpy of liquids: alkanes.

ESDU 86023

Heat capacity and enthalpy of liquids: alkenes and alkadienes.

ESDU 75015

Heat capacity and enthalpy of liquids: aromatic hydrocarbons.

ESDU 79028

Heat capacity and enthalpy of liquids: aliphatic alcohols.

ESDU 81030

Heat capacity and enthalpy of liquids: aliphatic ketones.

ESDU 76010

Heat capacity and enthalpy of liquids: halogenated methanes.

ESDU 77007

Heat capacity and enthalpy of liquids: halogenated ethanes and ethylenes.

ESDU 85024

Heat capacity and enthalpy of liquids: organic sulphur compounds (thiols and sulphides).

☐ Section 20: Viscosity - Common Liquids, Petroleum Products

ESDU 66024

Approximate data on the viscosity of some common liquids.

ESDU 68036

Introductory memorandum on the viscosity of liquids and the classification of lubricating oils.

ESDU 71003

A guide to the viscosity of liquid petroleum products.

☐ Section 21: Viscosity - Aliphatic Hydrocarbons

ESDU 79027

Viscosity of liquid alphatic hydrocarbons: alkanes.

ESDU 80015

Viscosity of liquid aliphatic hydrocarbons: alkenes.

☐ Section 22: Viscosity - Aromatic Hydrocarbons

ESDU 81016

Viscosity of liquid aromatic hydrocarbons.

ESDU 65008

Viscosity of liquid benzene.

☐ Section 23: Viscosity - Aliphatic and Cyclic Compounds Containing Oxygen

ESDU 06006

Viscosity of liquids: Aliphatic alcohols, glycols, and glycerol.

ESDU 06007

Viscosity of liquids: Glycol ethers.

ESDU 95019

Viscosity of liquids: Aliphatic ethers.

ESDU 94025

Viscosity of liquids: Aliphatic and cyclic ketones.

ESDU 95020

Viscosity of liquids: Carboxylic acids.

ESDU 96020

Viscosity of liquids: Straight chain aliphatic esters.

ESDU 06008

Viscosity of liquids: Branched chain aliphatic esters.

☐ Section 24: Viscosity - Aromatic Compounds Containing Oxygen

ESDU 03007

Viscosity of liquids: Aromatic compounds containing oxygen.

☐ Section 25: Viscosity - Organic Compounds Containing Nitrogen

ESDU 97027

Viscosity of liquids: Aliphatic amines.

ESDU 02001

Viscosity of liquids: Aliphatic nitriles.

ESDU 00053

Viscosity of liquids: Aromatic compounds containing nitrogen.

☐ Section 26: Viscosity - Inorganic Compounds

ESDU 76021

Dynamic viscosity of carbon dioxide gas and liquid.

☐ Section 27: Viscosity - Halogenated Hydrocarbons

ESDU 92028

Viscosity of liquids: Halogenated methanes.

ESDU 93012

Viscosity of liquids: Halogenated ethanes.

ESDU 98021

Viscosity of liquids: Halogenated propanes and higher alkanes.

ESDU 99022

Viscosity of liquids: Halogenated aromatic hydrocarbons.

☐ Section 28: Thermal Conductivity - Aliphatic Hydrocarbons

ESDU 05020

Thermal conductivity of liquids: Aliphatic hydrocarbons. Part 1. Alkanes.

ESDU 05021

Thermal conductivity of liquids: Aliphatic hydrocarbons. Part 2. Alkenes, dienes, and trienes.

☐ Section 29: Thermal Conductivity - Aromatic Hydrocarbons

ESDU 84010

Thermal conductivity of liquids: Aromatic hydrocarbons.

☐ Section 30: Thermal Conductivity - Alicyclic Compounds

ESDU 05010

Thermal conductivity of liquids: Alicyclic compounds - cycloalkanes, alkenes, alkanols, alkanones, and alkylamines.

☐ Section 31: Thermal Conductivity - Liquid Mixtures

ESDU 88004

Thermal conductivity of liquids: Mixtures.

☐ Section 32: Thermal Conductivity - Aliphatic Compounds Containing Oxygen

ESDU 93008

Thermal conductivity of liquids: Aliphatic alcohols.

ESDU 95018

Thermal conductivity of liquids: Aliphatic ethers.

ESDU 95008

Thermal conductivity of liquids: Glycol ethers.

ESDU 99013

Thermal conductivity of liquids: Glycols, glycerol and their aqueous solutions.

ESDU 97008

Thermal conductivity of liquids: Aliphatic aldehydes and ketones.

ESDU 93017

Thermal conductivity of liquids: Carboxylic acids.

ESDU 96018

Thermal conductivity of liquids: Straight chain aliphatic esters.

ESDU 96023

Thermal conductivity of liquids: Branched chain aliphatic esters.

ESDU 99012

Thermal conductivity of liquids: Aliphatic diesters.

☐ Section 33: Thermal Conductivity - Aromatic Compounds Containing Oxygen

ESDU 02002

Thermal conductivity of liquids: Aromatic compounds containing oxygen.

☐ Section 34: Thermal Conductivity - Aliphatic Compounds Containing Nitrogen and Oxygen

ESDU 97010

Thermal conductivity of liquids: Aliphatic amines.

ESDU 98002

Thermal conductivity of liquids: Aliphatic amino-alcohols, diamines, and nitroalkanes.

ESDU 00021

Thermal conductivity of liquids: Aliphatic nitriles.

☐ Section 35: Thermal Conductivity - Aromatic Compounds Containing Nitrogen and Oxygen

ESDU 00050

Thermal conductivity of liquids: Aromatic compounds containing nitrogen.

☐ Section 36: Thermal Conductivity - Cyclic Compounds Containing Nitrogen

ESDU 83015

Thermal conductivity of liquids: Heterocyclic nitrogen compounds.

☐ Section 37: Thermal Conductivity - Inorganic Compounds

ESDU 76030

Thermal conductivity of carbon dioxide gas and liquid.

☐ Section 38: Thermal Conductivity - Halogenated Aliphatic Hydrocarbons

ESDU 94021

Thermal conductivity of liquids: Halogenated aliphatic hydrocarbons. Part 1. Halogenated methanes and azeotropic mixtures.

ESDU 94022

Thermal conductivity of liquids: Halogenated aliphatic hydrocarbons. Part 2. Halogenated ethanes.

ESDU 94023

Thermal conductivity of liquids: Halogenated aliphatic hydrocarbons. Part 3. Halogenated higher hydrocarbons (C3 to C16).

ESDU 94024

Thermal conductivity of liquids: Halogenated aliphatic hydrocarbons. Part 4. Halogenated alkenes and alkadienes (C1 to C4).

☐ Section 39: Thermal Conductivity - Halogenated Aromatic Hydrocarbons

ESDU 98018

Thermal conductivity of liquids: Halogenated aromatic hydrocarbons.

☐ Section 40: Thermophysical Properties of Ideal and Dilute Gases - Hydrocarbons

ESDU 99011

Thermal conductivity, viscosity, isobaric specific heat capacity, and Prandtl number of gases at low pressure: Aliphatic hydrocarbons - alkanes.

ESDU 00051

Thermal conductivity, viscosity, isobaric specific heat capacity, and Prandtl number of gases at low pressure: hydrocarbons - alkenes, alkadienes, alkynes, cycloalkanes, aromatics.

☐ Section 41: Thermophysical Properties of Ideal and Dilute Gases - Inorganic Compounds

ESDU 99005

Thermal conductivity, viscosity, isobaric specific heat capacity, and Prandtl number of gases at low pressure: inorganic gases.

☐ Section 42: Thermophysical Properties of Ideal and Dilute Gases - Organic Compounds Containing Oxygen

ESDU 00019

Thermal conductivity, viscosity, isobaric specific heat capacity and Prandtl number of gases at low pressure: oxygenated aliphatic hydrocarbons - alcohols, aldehydes, ketones and ethers.

ESDU 00052

Thermal conductivity, viscosity, isobaric specific heat capacity and Prandtl number of gases at low pressure: oxygenated hydrocarbons-aliphatic esters.

☐ Section 43: Thermophysical Properties of Ideal and Dilute Gases - Halogenated Hydrocarbons

ESDU 02003

Thermal conductivity, viscosity, isobaric specific heat capacity and Prandtl number of gases at low pressure: halogenated hydrocarbons-halomethanes.

ESDU 02004

Thermal conductivity, viscosity, isobaric specific heat capacity and Prandtl number of gases at low pressure: halogenated hydrocarbons-haloethanes.

ESDU 03008

Thermal conductivity, viscosity, isobaric specific heat capacity and Prandtl number of gases at low pressure:
Halogenated hydrocarbons - halopropanes, butanes, ethylenes, benzenes.

☐ Section 44: Thermophysical Properties - Aliphatic Compounds, Refrigerants, Heterocyclic Compounds

ESDU 89005

Thermophysical properties of buta-1, 3-diene.

ESDU 95013

Thermophysical properties of methanol.

ESDU 89017

Thermophysical properties of propan-2-ol (isopropyl alcohol): Part 1. The ideal gas and the saturated liquid and vapor.

ESDU 89020

Thermophysical properties of isopropyl alcohol. Part II: thermodynamic properties at elevated pressures.

ESDU 94010

Thermophysical properties of MtBE (methyl tert-butyl ether).

ESDU 90017

Thermophysical properties of refrigerant R-22 (chlorodifluoromethane).

ESDU 93003

Thermophysical properties of refrigerant R-134a (1, 1, 1, 2-tetrafluoroethane).

ESDU 94032

Thermophysical properties of R-32 (difluoromethane).

ESDU 88016

Thermophysical properties of ethylene oxide.

ESDU 88020

Thermophysical properties of propylene oxide.

☐ Section 45: Thermophysical Properties - Aromatic Compounds

ESDU 82004

Thermophysical properties of industrially important fluids on the saturation line: Phenol.

ESDU 82032

Thermophysical properties of industrially important fluids on the saturation line: Cresols.

ESDU 83005

Thermophysical properties of industrially important fluids on the saturation line: Xylenols.

ESDU 88009

Thermophysical properties of toluene. Part I: the ideal gas and the saturated liquid and vapor.

ESDU 88010

Thermophysical properties of toluene. Part II: thermodynamic properties at elevated pressures.

ESDU 89002

Thermophysical properties of benzene. Part I: the ideal gas and the saturated liquid and vapor.

ESDU 89003

Thermophysical properties of benzene. Part II: thermodynamic properties at elevated pressures.

☐ Section 46: Thermophysical Properties - Inorganic Compounds

ESDU 81010

Thermophysical properties of industrially important fluids on the saturation line: ammonia.

ESDU 91040

Thermophysical properties of carbon monoxide.

ESDU 90003

Thermophysical properties of sulphur dioxide.

ESDU 91022

Thermophysical properties of nitrous oxide.

ESDU 92027

Thermophysical properties of nitric oxide.

ESDU 96034

Thermophysical properties of hydrogen sulphide.

ESDU 97028

Thermophysical properties of sulphur hexafluoride.

☐ Section 47: Fire Hazard Properties

ESDU 82030

Fire hazard properties: flash points, flammability limits, and autoignition temperatures.

☐ Section 48: Properties of Water Substance

ESDU 68008

Specific heat capacity at constant pressure of ice, water, and steam.

ESDU 68010

Density of ice, water, and steam.

ESDU 68023

Thermal conductivity, viscosity, heat capacity, density, and Prandtl number of solid, liquid, and gaseous heavy water.

ESDU 77024

Thermal conductivity, viscosity, heat capacity, density, and Prandtl number of sea water and its concentrates.

ESDU 78039

Thermal conductivity of ice, water, and steam.

ESDU 78040

Viscosity of water and steam.

ESDU 79017

Prandtl number of water and steam.

ESDU 80005

Surface tension of water.

Stress and Strength

☐ Section 1: Organizational Documents

ESDU 03003

Stress and Strength series organization: preface and amendment record.

ESDU CFS

Conversion factors.

EU SS1

Guide to the use of the Stress and Strength Series.

☐ Section 2: General Data

ESDU 72013

Principal stresses and strains in a two-dimensional stress field.

ESDU 72014

Determination of the principal stresses and strains in a plane stress field from strain gauge data.

ESDU 73004

Criteria of yielding for ductile materials under static loading.

ESDU 89052

Construction of inelastic stress-strain curves from minimal materials data (computer program).

ESDU 03005

AMOPS: Computer program for the calculation of area and moments of area of planar shapes.

☐ Section 3: Struts, Beams and Plates

ESDU SS3

Guide to Items on struts, beams, and shafts.

ESDU STRUCT 01.01.23

The buckling of a composite strut.

ESDU STRUCT 01.01.24

The compressive instability of hydraulic jacks.

ESDU STRUCT 01.06.00

Information on the use of data sheets 01.06.

ESDU STRUCT 01.06.01

Form factors for circular sections under combined bending and axial load.

ESDU STRUCT 01.06.02

Form factors for flanged sections under combined bending and axial load.

ESDU STRUCT 01.06.03

Form factors for angle, tee, and channel sections under combined bending and axial load.

ESDU 71004

Flange efficiency factors for curved beams under bending in the plane of curvature.

ESDU 78030

Struts with lateral loads.

ESDU 88034

Avoidance of buckling of some engineering elements (struts, plates and gussets).

☐ Section 4: Plates under Pressure

ESDU 65002

Elastic stresses and deflections for flat circular plates with D/t greater than or equal to 4 under uniform pressure.

ESDU 65003

Elastic stresses and deflections for flat circular plates with D/t greater than or equal to 20 under uniform pressure.

ESDU 69018

Elastic stresses and deflections for long flat rectangular plates under uniformly distributed and linearly varying normal pressure.

ESDU 69019

Elastic stresses and deflections for long rectangular plates with small initial curvature under uniformly distributed normal pressure on the concave face.

ESDU 70001

Elastic stresses and deflections for flat square plates under uniformly distributed normal pressure.

ESDU 71013

Elastic direct stresses and deflections for flat rectangular plates under uniformly distributed normal pressure.

ESDU 87036

Elastic stresses and deflections for square plates with small initial curvature under uniform pressure on the concave or convex face.

ESDU 94033

Flat rectangular isotropic plates under uniformly distributed normal pressure. Elastic deflections, stresses and strains, moments and forces, for various forms of edge restraint.

☐ Section 5: Shafts

ESDU 68002

Shafts with interference-fit collars. Part I: some factors affecting the design of an assembly.

ESDU 68003

Shafts with interference-fit collars. Part II: nominal elastic interface pressures and stresses.

ESDU 68004

Shafts with interference-fit collars. Part III: procedure for calculation of nominal elastic interface pressures and stresses in assemblies of three or more elements.

ESDU 68005

Shafts with interference-fit collars.
Part IV: fatigue strength of plain shafts.

ESDU 69017

The deflections and slopes of shafts or beams of constant or stepped section.

ESDU 73002

Fatigue of steel spline assemblies under reversed torsion.

ESDU 86028

Fatigue strength of keyed assemblies.

☐ Section 6: Pipes

ESDU 68047

Straight pipes under internal pressure.
Effect of bore eccentricity on maximum stress.

ESDU 68048

Straight pipes under internal pressure.
Effect of initial non-circularity on maximum stress.

ESDU 74043

Flexibilities of and stresses in unrestrained pressurised thin pipe bends subjected to in-plane bending.

ESDU 75014

Flexibilities of and stresses in thin pipe bends under in-plane bending: influence of bend angle and tangent pipe ends.

ESDU 81041

Flexibilities of and stresses in thin unpressurised pipe bends with flanged ends under in-plane bending: influence of bend angle.

☐ Section 7: Pressure Vessels

ESDU 66010

Elastic stresses in a long circular cylindrical shell with a flat head closure under uniform pressure.

SDU 67014

Fatigue strength of thick cylinders under internal pressure.

ESDU 67017

Elastic stresses in the torispherical head of a pressure vessel of uniform thickness.

☐ Section 8: Stress Concentrations

ESDU 64001

Guide to stress concentration data.

ESDU 67023

Geometric stress concentrations. Two equal unreinforced circular holes in infinite flat plates.

ESDU 75007

Geometric stress concentration factors: two adjacent unreinforced circular holes in infinite flat plates.

ESDU 75033

Elastic stress concentration factors. Double radius fillets in shouldered shafts in torsion.

ESDU 79008

Elastic stress concentration factors. Rectangular notch in the edge of a wide flat plate in tension.

ESDU 79032

Stress concentrations at grooves for retaining rings or seals (with notes on design against fatigue).

ESDU 80027

Elastic stress concentration factors.
Single reinforced
and unreinforced holes in infinite plates of isotropic materials.

ESDU 81006

Stress concentration factors. Axially loaded lugs with clearance-fit pins.

ESDU 85045

Stress concentrations: interaction
and stress decay
for selected cases.

ESDU 89048

Elastic stress concentration factors.
Geometric discontinuities in rods and tubes of isotropic materials.

ESDU 93030

Three-dimensional elastic stress concentration factors. Plain or countersunk hole in a wide plate subjected to tension, bending, or pin loading.

ESDU 09014

Elastic stress concentration factors. Geometric discontinuties in flat bars or strips of isotropic material.

ESDU 15004

Stress concentration factors in keyways.

ESDU 15005

Stress concentration factors for optimised holes in flat plate.

ESDU 15006

Stress concentration factors for optimised notches and fillets in flat plate.

☐ Section 9: Fatigue - General

ESDU 20004

Guide to fatigue data available in Stress and Strength of Components Series.

ESDU 70016

Terms and notation for fatigue endurance data.

ESDU 71009

Design against fatigue. Design principles.

ESDU 75022

Design against fatigue. Basic design calculations.

ESDU 87016

Effect of size on fatigue strength of steel components.

ESDU 90031

Fretting fatigue.

ESDU 91027

Non-destructive examination - choice of methods.

ESDU 97024

Derivation of endurance curves from fatigue test data, including run-outs.

ESDU 04022

An introduction to low-cycle fatigue phenomena.

☐ Section 10: Fatigue Strength of Materials

ESDU 19004

Guide to the effect of shot peening on fatigue strength.

ESDU 71027

Endurance of high strength steels (in bending).

ESDU 74016

The fatigue strength at high endurance of notched low alloy steel specimens (in bending and under axial loading, zero mean stress).

ESDU 74027

The effect of surface roughness on the fatigue limit of steels (at zero mean stress).

ESDU 86033

The effect of electrodeposited chromium on the fatigue strength of low alloy steel.

ESDU 88008

Fatigue limit of unnotched steels (related to tensile strength).

ESDU 88027

Effect of fretting on fatigue strength of titanium alloys.

ESDU 89031

Guide to the selection of surface treatments for the improvement of fatigue strength of steels.

ESDU 05007

Strain-life data for type 316 austenitic stainless steels at temperatures between -269 and 816 degrees C (-452 and 1501 degrees F).

ESDU 05008

Cyclic stress-strain response of type 316 austenitic stainless steels during low-cycle fatigue at temperatures between -269 and 800 °C (-452 and 1472 °F).

☐ Section 11: Statistical Methods

ESDU 91041

The statistical analysis of data from Normal distributions, with particular reference to small samples.

ESDU 92040

An introduction to the statistical analysis of engineering data.

☐ Section 12: Fracture Mechanics - General

ESDU 80036

Introduction to the use of linear elastic fracture mechanics in estimating fatigue crack growth rates and residual strength of components.

ESDU 83023

Fracture toughness (KIc) values of some steels.

ESDU 96013

Fracture toughness (KIc) values of some aluminium alloys.

ESDU 02016

Fracture toughness (KIc) values of some cast irons.

☐ Section 13: Crack Propagation

ESDU 81011

Fatigue crack propagation in low and medium strength low alloy steel plate, bar and forgings.

ESDU 81012

Fatigue threshold stress intensity factors and slow crack propagation rates in low and medium strength low alloy steel.

ESDU 84003

Fatigue crack propagation rates and threshold stress intensity factors in high alloy and corrosion resistant (stainless) steel.

ESDU 93033

Fatigue propagation behavior of short cracks (1-2 mm) in steels.

ESDU 17003 (Superseded 85019)

Fatigue crack propagation rates and threshold stress intensity factors in high strength low alloy steel plate, bar and forgings.

☐ Section 14: Stress Intensity Factors

ESDU 78036

The compounding method of estimating stress intensity factors for cracks in complex configurations using solutions from simple configurations.

ESDU 81029

Stress intensity factors in lugs (through-thickness cracks).

ESDU 83033

Stress intensity factors for corner cracks in loaded holes in lugs and wide plates.

☐ Section 15: Bolted Joints and Screw Threads

ESDU 66011

Loaded pins in axially loaded bars. Maximum elastic stress at hole boundary.

ESDU 67019

Static strength of screwed fasteners.

ESDU 67020

Fatigue strength of steel screw threads with large root radii under axial loading.

ESDU 67034

Effect of inclined nut seatings on the fatigue strength of steel screw threads.

ESDU 71011

Stresses due to interference-fit pins and bushes in plates, strips, or lugs.

ESDU 80028

Fatigue strength of large steel bolts and threaded connections under axial loading.

ESDU 82022

Endurance of steel lugs with clearance-fit pins (Tensile mean stress).

ESDU 84037

Fatigue strength of external and internal steel screw threads under axial loading. (Standard forms not greater than 1.0 inch diameter.)

ESDU 13008

Fatigue strength of low-carbon steel stud threads under axial and combined axial and bending loading.

ESDU 85021

Analysis of pretensioned bolted joints subject to tensile (separating) forces.

ESDU 14001

Applying, measuring and maintaining pretension in steel bolts.

ESDU 14002

Lock nuts and other thread locking devices.

ESDU 96014

Fatigue of bolted steel lap joints and doublers.

ESDU 13015

An introduction to some methods to calculate loads and stiffnesses in bolted assemblies.

ESDU 13016

Some factors affecting the design of bolted assemblies.

ESDU TM 175

ESDU TECHNICAL MEMORANDUM
Self-loosening of bolted joints.

ESDU 14003

Guide to bolted joints and screw threads data.

ESDU 91008

Strength of lugs under axial load.

ESDU 08007

Strength of lugs under oblique load.

ESDU 06021

Strength of lugs under transverse load.

☐ Section 16: Welds in Aluminium Alloys

ESDU 91039

Static and fatigue strength of butt welded joints in aluminium alloys.

ESDU 92017

Fatigue strength of cruciform and other fillet welded joints in aluminium alloys.

☐ Section 17: Welds in Steel

ESDU 75016

Fatigue strength of transverse fillet and cruciform butt welds in steels.

ESDU 76007

Fatigue of longitudinal fillet welded attachments and joints in steels under axial loading.

ESDU 76032

Fatigue strength of longitudinal flange-to-web welds in steel I-beams and T-sections.

ESDU 77011

Fatigue strength of transverse butt welds in steel plate under axial loading.

ESDU 78016

The effect of post-weld treatments on fatigue at fillet welded attachments.

ESDU 78023

Fatigue strength of transverse welded joints and attachments in steels under bending loading.

ESDU 81007

Fatigue strength in bending of steel I-beams with welded attachments.

ESDU 86013

Guide to the use of Data Items on the fatigue strength of welded joints in steels.

☐ Section 18: Bonded Joints

ESDU 17004

Guide to the use of Data Items in the design of bonded joints.

ESDU 18008

An overview of bonded joint design.

ESDU 67008

Elastic stresses in single lap joints under tension or compression.

ESDU 92041

Stress analysis of single lap bonded joints (adhesive and adherends).

☐ Section 19: Disc and Strip Springs

ESDU 67021

The design of crossed flexure-pivots.

ESDU 78043

Single disc springs - elastic deflections, stresses, stiffnesses, and resiliences.

ESDU 79010

Characteristics of disc springs in combination (to be used in conjunction with ESDU 78043).

ESDU 80004

Fatigue strength of steel coned disc springs.

☐ Section 20: Helical Springs

ESDU 19003

Fatigue strength of shot peened helical tension and compression steel springs.

ESDU 82008

Elastic stresses and deflections of helical compression and tension springs of round wire.

ESDU 82012

Nested helical compression springs of round wire (to be used in conjunction with ESDU 82008).

ESDU 83002

Allowable stresses for helical compression and tension springs of round wire.

ESDU 83003

Notes on the design of helical compression and tension springs of round wire.

☐ Section 21: Contact Stresses

ESDU 78035

Contact phenomena. I: stresses, deflections, and contact dimensions for normally-loaded unlubricated elastic components.

ESDU 84017

Contact phenomena. II: stress fields and failure criteria in concentrated elastic contacts under combined normal and tangential loading.

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☐ Section 1: Organizational Documents

ESDU 00030

Structures Series organization: preface amendment record.

☐ Section 2: General Data

ESDU CFS

Conversion factors.

ESDU STRUCT 02.00.00

Criteria of yielding and failure.

ESDU 68003

Shafts with interference-fit collars. Part II: nominal elastic interface pressures and stresses.

ESDU 72013

Principal stresses and strains in a two-dimensional stress field.

ESDU 72014

Determination of the principal stresses and strains in a plane stress field from strain gauge data.

ESDU 76016

Generalization of smooth continuous stress-strain curves for metallic materials.

ESDU 83044

Plasticity correction factors for plate buckling.

ESDU 91041

The statistical analysis of data from Normal distributions, with particular reference to small samples.

ESDU 92040

An introduction to the statistical analysis of engineering data.

☐ Section 3: Section Constants

ESDU STRUCT 00.06.00

Information on the use of Data Items in the Struct 00.06. Series.

ESDU STRUCT 00.06.01

Method of calculating stress distribution in a reinforced symmetrical shell under bending.

ESDU STRUCT 00.06.04

Shear center of circular arc section.

ESDU STRUCT 00.06.05

Shear center of D-section.

ESDU STRUCT 00.07.00

Information on the use of Data Sheets in the 00.07 series.

ESDU STRUCT 00.07.01

Torsion and secondary warping constants for a bulb angle.

ESDU STRUCT 00.07.04

Primary warping constant for Z-sections with bulbs.

ESDU STRUCT 01.00.01

Flexural properties of stringer sections (lipped and unlipped angles, channels, and Z-sections).

ESDU 77023

Shear center and primary warping constant for lipped and unlipped channel and Z-sections.

ESDU 03005

AMOPS: Computer program for the calculation of area and moments of area of planar shapes.

☐ Section 4: Stress Concentrations

ESDU 64001

Guide to stress concentration data.

ESDU 67008

Elastic stresses in single lap joints under tension or compression.

ESDU 67023

Geometric stress concentrations. Two equal unreinforced circular holes in infinite flat plates.

ESDU 71011

Stresses due to interference-fit pins and bushes in plates, strips, or lugs.

ESDU 75007

Geometric stress concentration factors: two adjacent unreinforced circular holes in infinite flat plates.

ESDU 75033

Elastic stress concentration factors. Double radius fillets in shouldered shafts in torsion.

ESDU 79008

Elastic stress concentration factors. Rectangular notch in the edge of a wide flat plate in tension.

ESDU 79032

Stress concentrations at grooves for retaining rings or seals (with notes on design against fatigue).

ESDU 80027

Elastic stress concentration factors. Single reinforced and unreinforced holes in infinite plates of isotropic materials.

ESDU 81006

Stress concentration factors.
Axially loaded lugs with clearance-fit pins.

ESDU 89048

Elastic stress concentration factors. Geometric discontinuities in rods and tubes of isotropic materials.

ESDU 93030

Three-dimensional elastic stress concentration factors. Plain or countersunk hole in a wide plate subjected to tension, bending, or pin loading.

ESDU 09014

Elastic stress concentration factors. Geometric discontinuties in flat bars or strips of isotropic material.

☐ Section 5: Beams

ESDU STRUCT 01.06.00

Information on the use of data sheets 01.06.

ESDU STRUCT 01.06.01

Form factors for circular sections under combined bending and axial load.

ESDU STRUCT 01.06.02

Form factors for flanged sections under combined bending and axial load.

ESDU STRUCT 01.06.03

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ESDU 18001

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ESDU 18002

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ESDU 18003

Form factors for flanged sections under combined bending and axial load.

ESDU 18004

Form factors for angle, tee and channel sections under combined bending and axial load.

ESDU 69017

The deflections and slopes of shafts or beams of constant or stepped section.

ESDU 71004

Flange efficiency factors for curved beams under bending in the plane of curvature.

ESDU 88035

Maximum inelastic bending moments and form factors for symmetric bending of beams.

ESDU 90004

Maximum inelastic bending moments and end loads in fixed ratio for beam sections of general polygonal shape (computer program).

ESDU 90026

Inelastic bending moments, end loads, stresses and strains for beam sections of general polygonal shape.

☐ Section 6: Buckling of Rectangular Plates and Panels in Compression

ESDU STRUCT 02.01.02

Average and edge stresses for long flat plates in compression for different edge conditions.

ESDU STRUCT 02.01.03

Average and edge stresses for thin flat aluminium alloy plates in compression.

ESDU STRUCT 02.01.08

Buckling in compression of sheet between rivets.

ESDU STRUCT 02.01.09

Inter-rivet buckling curves for specific materials.

ESDU STRUCT 02.01.10

Buckling stress coefficients for slightly curved plates with clamped edges.

ESDU STRUCT 02.01.11

Average and edge stresses for slightly curved plates with clamped edges in compression with initial irregularities.

ESDU STRUCT 02.01.16

Strength of stringers in panel in compression.

ESDU STRUCT 02.01.17

Nomogram for strength of stringers in panel in compression.

ESDU STRUCT 02.01.22

Buckling stress coefficients for flat rectangular plates in compression. (Edges restrained against rotation - antisymmetric rotation.)

ESDU STRUCT 02.01.23

Average and edge stresses in long flat rectangular plates in compression under varying edge conditions.

ESDU STRUCT 02.01.24

Stiffness after buckling. Flat rectangular plates in compression. (Edges simply-supported.)

ESDU STRUCT 02.01.50

Initial buckling of slightly curved plates under combined longitudinal and circumferential direct stress. (All edges simply-supported.)

ESDU 72012

Information on the use of Data Items on the buckling of plates and compression panels manufactured from isotropic materials.

ESDU 72019

Buckling of flat isotropic plates under uniaxial and biaxial loading.

ESDU 98016

Elastic buckling of flat isotropic stiffened panels and struts in compression.

ESDU 01001

Elasto-plastic buckling of flat isotropic stiffened panels and struts in compression.

ESDU 03001

Elastic buckling of long, flat, symmetrically-laminated (AsBoDf), composite stiffened panels and struts in compression.

☐ Section 7: Buckling of Rectangular Plates under Combined Loadings

ESDU STRUCT 02.04.01

Buckling stress ratios for plates under uniform compression and shear.

ESDU STRUCT 02.04.02

Average and edge stresses for flat plates under shear and compression.

ESDU STRUCT 02.04.04

Initial buckling of flat plates under bending and compression or tension.

ESDU STRUCT 02.04.05

Initial buckling of flat plates under compression, bending, and shear.

ESDU 69003

The buckling of flat plates under non-uniform compression. Symmetric distributions due to initial or thermal stress.

ESDU 70002

Buckling stress ratios for flat plates under shear and non-uniform compression.

ESDU 80035

Buckling of outstanding flanges. Direct stresses varying linearly or parabolically.

☐ Section 8: Buckling of Non-Rectangular Plates

ESDU STRUCT 02.01.46

Buckling stress coefficients for flat parallelogram plates under uniform compression. (All edges fixed against rotation.)

ESDU STRUCT 02.01.47

Buckling stress coefficients for parallelogram shaped panels in continuous flat sheet under uniform compression.

ESDU STRUCT 02.01.48

Buckling stress coefficients for flat plates tapered in plan, under compression.

ESDU STRUCT 02.01.49

Buckling stress coefficients for flat rectangular plates tapered in thickness, under compression.

ESDU 09013

Initial buckling of flat isosceles triangular plates under compression reacted by compression and/or shear.

☐ Section 9: Buckling of Flat Rectangular Plates and Panels in Shear

ESDU STRUCT 02.03.02

Flat panels in shear. Buckling of long panels with transverse stiffeners.

ESDU 71005

Buckling of flat plates in shear.

ESDU 74022

Buckling of corrugated shear webs.

ESDU 75034

Initial buckling stress, maximum direct stress, and shear strain of square plates in shear with central circular holes.

ESDU 75035

Initial buckling of square plates in shear with central flanged circular holes.

ESDU 77014

Flat panels in shear. Post-buckling analysis.

ESDU 02005

Flat panels in shear. Post-buckling analysis.

☐ Section 10: Buckling of Curved Plates and Panels in Shear

ESDU STRUCT 02.03.18

Buckling stress coefficients for curved plates in shear (axial length exceeding circumferential length, edges simply-supported).

ESDU STRUCT 02.03.19

Buckling stress coefficients for curved plates in shear (circumferential length exceeding axial length, edges simply-supported).

ESDU STRUCT 02.03.24

Strength of castellations in shear.

ESDU 77018

Curved panels in shear. Post-buckling analysis.

☐ Section 11: Laminated Composites - Analysis and Design

ESDU 82013

Laminate stacking sequences for special orthotropy. (Application to fibre reinforced composites).

ESDU 85001

Elastic stress and strain distributions around circular holes in infinite plates of orthotropic material (applicable to fibre reinforced composites).

ESDU 86003

Example of the use of Data Item No. 85001. Choice of reinforcement for a circular hole in a fibre reinforced laminated plate. (Data relating to one particular set of laminate properties.)

ESDU 89013

Transverse (through-the-thickness) shear stiffnesses of fibre reinforced composite laminated plates.

ESDU 94003

Stiffnesses of laminated flat plates.

ESDU 94004

Stress analysis of laminated flat plates.

ESDU 96036

Design of laminated plates subjected to in-plane loads and bending moments.

ESDU 03013

Thickness selection for the flanges and web of a composite I-section beam subjected to bending and shear.

☐ Section 12: Buckling of Balanced Laminated Composites

ESDU 73015

Estimation of the local buckling stress under biaxial compression of an isotropic skin with fibre reinforced integral unflanged stiffeners.

ESDU 80023

Buckling of rectangular specially orthotropic plates.

ESDU 81047

Buckling of flat rectangular plates (isotropic, orthotropic, and laminated composite plates and sandwich panels).

ESDU 94005

Buckling of flat rectangular orthotropic plates.

ESDU 94007

Elastic buckling of cylindrically curved laminated fibre reinforced composite panels with all edges simply-supported under biaxial loading.

☐ Section 13: Buckling of Unbalanced Laminated Composites

ESDU 94006

Elastic buckling of unbalanced laminated fibre reinforced composite plates. (Rectangular plates of AsBtDs type, all edges simply-supported under biaxial loading.)

☐ Section 14: Laminated Composites - Failure Criteria

ESDU 82025

Failure modes of fibre reinforced laminates.

ESDU 83014

Failure criteria for an individual layer of a fibre reinforced composite laminate under in-plane loading.

ESDU 84018

Failure analysis of fibre reinforced composite laminates.

ESDU 91003

Delamination of tapered composites.

ESDU 94019

Through-the-thickness stresses and failure in the corner radius of a laminated composite section.

ESDU 95028

Delamination and free edge stresses in composite laminates subjected to uniform prescribed axial strain and temperature change.

☐ Section 15: Sandwich Panels under Normal Loading

ESDU 73025

Stresses in the core of a sandwich panel under local normal loading.

ESDU 76013

Elastic stresses and deflections under uniform pressure of flat rectangular sandwich panels; all edges simply-supported (isotropic face plates and orthotropic cores of zero flexural stiffness).

ESDU 76022

Elastic stresses and deflections under uniform pressure of flat rectangular sandwich panels; long edges clamped, short edges simply-supported (isotropic face plates and orthotropic cores of zero flexural stiffness).

ESDU 77003

Elastic stresses and deflections under uniform pressure of flat rectangular sandwich panels; all edges clamped (isotropic face plates and orthotropic cores of zero flexural stiffness).

☐ Section 16: Sandwich Panels with Composite Face Plates

ESDU 87013

Elastic wrinkling of sandwich columns and beams with unbalanced laminated fibre reinforced face plates (face plates of AsBoDs, AsBlDs and AsBsDs types).

ESDU 88015

Elastic wrinkling of sandwich panels with laminated fibre reinforced face plates (face plates of AsBoDs, AsBlDs, and AsBsDs types).

☐ Section 17: Buckling of Sandwich Panels

ESDU STRUCT 07.03.01

Sandwich panels with corrugated core and equal face plates. Transverse shear stiffness.

ESDU 66025

Experimental determination of the shear and flexural stiffnesses of a sandwich panel.

ESDU 67022

Modulus of rigidity of sandwich panels with hexagonal cell cores.

ESDU 67024

Buckling loads in shear of flat sandwich panels. (Isotropic face plates and orthotropic cores of zero flexural stiffness, all edges simply-supported.)

ESDU 67025

Buckling loads under combined longitudinal and transverse direct stress of flat sandwich panels. (Isotropic face plates and orthotropic cores of zero flexural stiffness, all edges simply-supported.)

ESDU 67026

Buckling loads in shear of flat sandwich panels. (Isotropic face plates and corrugated cores, all edges simply-supported.)

ESDU 67032

Buckling loads under combined longitudinal and transverse direct stress of flat sandwich panels. (Isotropic face plates and corrugated cores, all edges simply-supported.)

ESDU 68029

Information on the use of Data Items on sandwich panels.

ESDU 68030

Buckling loads in shear of flat sandwich panels. (Isotropic face plates and orthotropic cores of zero flexural stiffness, all edges clamped.)

ESDU 68031

Buckling loads under combined longitudinal and transverse direct stress of flat sandwich panels. (Isotropic face plates and orthotropic cores of zero flexural stiffness, all edges clamped.)

ESDU 68032

Buckling loads in shear of flat sandwich panels. (Isotropic face plates and corrugated cores, all edges clamped.)

ESDU 68033

Buckling loads under combined longitudinal and transverse direct stress of flat sandwich panels. (Isotropic face plates and corrugated cores, all edges clamped.)

ESDU 68037

Local instability of bonded corrugated-core sandwich panels under longitudinal compression. (Symmetrical cores with identical face plates.)

ESDU 80010

Local instability of truss core sandwich panels under longitudinal compression.

ESDU 88032

Wrinkling of sandwich panel face plates (isotropic face plates on orthotropic cores, in-plane loading or bending).

☐ Section 18: Isotropic Plates under Pressure

ESDU 65002

Elastic stresses and deflections for flat circular plates with D/t greater than or equal to 4 under uniform pressure.

ESDU 65003

Elastic stresses and deflections for flat circular plates with D/t greater than or equal to 20 under uniform pressure.

ESDU 69018

Elastic stresses and deflections for long flat rectangular plates under uniformly distributed and linearly varying normal pressure.

ESDU 69019

Elastic stresses and deflections for long rectangular plates with small initial curvature under uniformly distributed normal pressure on the concave face.

ESDU 70001

Elastic stresses and deflections for flat square plates under uniformly distributed normal pressure.

ESDU 71013

Elastic direct stresses and deflections for flat rectangular plates under uniformly distributed normal pressure.

ESDU 87036

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☐ Section 19: Composite Plates under Pressure

ESDU 93011

Flat rectangular orthotropic plates under uniformly distributed normal pressure. Elastic stresses and deflections for various forms of edge restraint.

☐ Section 20: Struts

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The strength of struts.

ESDU STRUCT 01.01.08

Local instability of struts with flat sides.

ESDU STRUCT 01.01.10

Torsional instability of stringers and struts of angle section.

ESDU STRUCT 01.01.19

Local buckling and crippling of rectangular tube section struts.

ESDU STRUCT 01.01.23

The buckling of a composite strut.

ESDU STRUCT 01.01.24

The compressive instability of hydraulic jacks.

ESDU 76023

Buckling of struts. Lipped and unlipped channel sections.

ESDU 77030

Buckling of struts. Lipped and unlipped Z sections.

ESDU 78020

Local buckling and crippling of I, Z and channel section struts.

ESDU 78021

Guide to Items on the strength and stability of struts.

ESDU 78030

Struts with lateral loads.

ESDU 89007

Flexural and torsional-flexural buckling of thin-walled open section struts.

ESDU 90002

Struts: strength under flexural, local, and inter-rivet buckling.

ESDU 92038

Equivalent lengths of struts (for use in buckling calculations).

☐ Section 21: Local Buckling

ESDU STRUCT 02.01.28

Information on the use of Item No. 73007.

ESDU STRUCT 02.01.34

Estimation of the initial buckling stress

under uniaxial compression of a skin with integral unflanged stiffeners.

ESDU STRUCT 02.01.35

Estimation of the initial buckling stress under uniaxial compression of a skin with Z-section stringers.

ESDU STRUCT 02.01.36

Estimation of the initial buckling stress under uniaxial compression of a skin with top hat section stringers.

ESDU STRUCT 02.01.37

Estimation of the initial buckling stress under uniaxial compression of a corrugated sandwich panel.

ESDU 70003

Local buckling of compression panels with unflanged integral stiffeners.

ESDU 71014

Local buckling of compression panels with flanged stringers.

ESDU 73007

Stiffness of loaded flat strips under sinusoidally distributed bending couples at their edges (for use in local buckling calculations). (Uniaxial or biaxial loading. Isotropic or orthotropic materials.)

☐ Section 22: Design for Minimum Weight

ESDU 66006

Design for minimum weight. Struts of uniform section. Thin-walled square tubes.

ESDU 66007

Design for minimum weight. Struts of uniform section. I-sections.

ESDU 66008

Design for minimum weight. Struts of uniform section. Minimum weights for various sections.

ESDU 70007

Design for minimum weight. Compression panels with unflanged integral stiffeners having dimensional restrictions.

ESDU 75006

Design for maximum structural efficiency. Isotropic sandwich panels under uniaxial compression.

ESDU 85014

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☐ Section 23: Circular Frames

ESDU STRUCT 03.06.00

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ESDU STRUCT 03.06.01

Moments in circular frame due to concentrated loads and couples.

ESDU STRUCT 03.06.02

Direct forces in circular frame due to concentrated loads and couples.

ESDU STRUCT 03.06.03

Shear forces in circular frame due to concentrated loads and couples.

ESDU STRUCT 03.06.04

Radial deflections of circular frame due to concentrated loads and couples.

ESDU STRUCT 03.06.05

Bending moment in elliptical frames due to internal pressure.

ESDU STRUCT 03.06.06

Flexible circular frames supported by a shell. Moments in a frame due to concentrated couples.

ESDU STRUCT 03.06.07

Flexible circular frames supported by a shell. Moments in a frame due to concentrated tangential loads.

ESDU STRUCT 03.06.08

Flexible circular frames supported by a shell. Moments in a frame due to concentrated radial loads.

ESDU STRUCT 03.06.09

Flexible circular frames supported by a shell. Direct forces in a frame due to concentrated couples.

ESDU STRUCT 03.06.10

Flexible circular frames supported by a shell. Direct forces in a frame due to concentrated tangential loads.

ESDU STRUCT 03.06.11

Flexible circular frames supported by a shell. Direct forces in a frame due to concentrated radial loads.

ESDU STRUCT 03.06.12

Flexible circular frames supported by a shell. Shear forces in a frame due to concentrated couples.

ESDU STRUCT 03.06.13

Flexible circular frames supported by a shell. Shear forces in a frame due to tangential loads.

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Flexible circular frames supported by a shell. Shear forces in a frame due to concentrated radial loads.

ESDU STRUCT 03.06.15

Flexible circular frames supporting a shell. Displacements due to concentrated loads and couples.

ESDU STRUCT 03.06.16

Flexible circular frames supporting a shell. Shear flow from shell to frame due to concentrated loads and couples.

ESDU STRUCT 03.06.17

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ESDU 83043

Flexible circular frames supported by a shell. Moments, forces and displacements due to concentrated loads and couples.

ESDU 05003

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ESDU 05004

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☐ Section 24: Diffusion Problems

ESDU STRUCT 02.05.00

Diffusion of loads into flat uniform panels.

☐ Section 25: Cylinders and Pipes

ESDU STRUCT 04.09.01

Collapse coefficients for unstiffened circular cylinders under uniform external pressure.

ESDU 66010

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ESDU 67017

Elastic stresses in the torispherical head of a pressure vessel of uniform thickness.

ESDU 68047

Straight pipes under internal pressure.
Effect of bore eccentricity on maximum stress.

ESDU 68048

Straight pipes under internal pressure.
Effect of initial non-circularity on maximum stress.

ESDU 74043

Flexibilities of and stresses in unrestrained pressurised thin pipe bends subjected to in-plane bending.

ESDU 75014

Flexibilities of and stresses in thin pipe bends under in-plane bending: influence of bend angle and tangent pipe ends.

ESDU 81041

Flexibilities of and stresses in thin unpressurised pipe bends with flanged ends under in-plane bending:
influence of bend angle.

ESDU 83034

Elastic local buckling stresses of thin-walled unstiffened circular cylinders under combined axial compression and internal pressure.

ESDU 84006

Elastic buckling of thin-walled unstiffened circular cylinders under bending, axial compression, and internal pressure.

ESDU 84012

Buckling of thin-walled unstiffened circular cylinders under torsion and pressure.

☐ Section 26: Bolted Joints

ESDU 84039

Strength of angles and club-foot fittings (transmitting tensile loads).

ESDU 85021

Analysis of pretensioned bolted joints subject to tensile (separating) forces.

ESDU 14001

Applying, measuring and maintaining pretension in steel bolts.

ESDU 91008

Strength of lugs under axial load.

ESDU 06021

Strength of lugs under transverse load.

ESDU 08007

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ESDU 14006

Prediction of loads in shear clear attachments.

☐ Section 27: Bonded Joints

ESDU 17004

Guide to the use of Data Items in the design of bonded joints.

ESDU 78042

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ESDU 79016

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ESDU 80011

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☐ Section 28: Hot Structures

ESDU 69015

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ESDU 89021

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ESDU 89022

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ESDU 89023

Temperatures in plates subjected to a recovery temperature varying linearly with time.

ESDU 89024

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ESDU 89025

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ESDU 89026

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ESDU 89027

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☐ Section 29: Component Idealisation for Finite Element Analysis

ESDU 84042

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ESDU 98012

Flexibility of, and load distribution in, multi-bolt lap joints subject to in-plane axial loads.

Transonic Aerodynamics

☐ Section 1: Explanatory and General Guidance

ESDU 99034

Transonic Aerodynamics Series organization: preface, location schedule, amendment record.

ESDU 90008

Introduction to transonic aerodynamics of aerofoils and wings.

☐ Section 2: Aerofoils - Estimation of Pressure Distribution

ESDU TD MEMO 6511

A method for estimating the pressure distribution between the crest and the trailing edge on the surface of an aerofoil section in a sonic stream.

ESDU 69013

A method for estimating the pressure distribution on the surface of a two-dimensional aerofoil in a sonic stream.

ESDU 72025

Second-order method for estimating the subcritical pressure distribution on a two-dimensional aerofoil in compressible inviscid flow.

ESDU 76002

First-order method for estimating the subcritical pressure distribution on a two-dimensional aerofoil in compressible viscous flow.

☐ Section 3: Aerofoils - Computational Methods

ESDU 79009

Numerical methods for solving the potential flow equations for two-dimensional aerofoils in subsonic and transonic flows: brief details, test cases, and examples.

ESDU 81019

Methods for estimating the pressure distribution on a two-dimensional aerofoil in viscous transonic flow.

☐ Section 4: Aerofoils - Drag Rise, Designs, Separation

ESDU TD MEMO 6407

A method of estimating drag-rise Mach number for two-dimensional aerofoil sections.

ESDU 71019

Drag-rise Mach number of aerofoils having a specified form of upper-surface pressure distribution: charts and comments on design.

ESDU 71020

Aerofoils having a specified form of upper-surface pressure distribution: details and comments on design.

ESDU 78010

The lift achievable by aerofoils having a particular form of supercritical upper-surface pressure distribution that yields only small wave drag.

ESDU 81020

A method of estimating a separation boundary for two-dimensional aerofoil sections in transonic flow.

ESDU 92008

Direct prediction of a separation boundary for aerofoils using a viscous-coupled calculation method.

☐ Section 5: Aerofoils - Excrescence Drag Magnification

ESDU 18009

The estimation of turbulent boundary layer power-law velocity and q profiles from shape factor and momentum thickness.

ESDU 87004

Calculations of excrescence drag magnification due to pressure gradients at high subsonic speeds.

ESDU TM 181

An assessment of methods for estimation of turbulent boundary-layer profiles.

☐ Section 6: VGK Aerofoil Method

ESDU 96028

VGK method for two-dimensional aerofoil sections. Part 1: Principles and results.

ESDU 96029

VGK method for two-dimensional aerofoil sections. Part 2: user manual for operation with MS-DOS and UNIX systems.

ESDU 97030

VGK method for two-dimensional aerofoil sections. Part 3: estimation of a separation boundary in transonic flow.

ESDU 98031

VGK method for two-dimensional aerofoil sections. Part 4: estimation of excrescence drag at subsonic speeds.

ESDU 99032

VGK method for two-dimensional aerofoil sections. Part 5: design to a specified upper-surface pressure distribution.

ESDU 01033

VGK method for two-dimensional aerofoil sections. Part 6: aerofoil with simple hinged flaps.

ESDU 03015

Transonic data memorandum. VGK method for two-dimensional aerofoil sections. Part 7: VGK for Windows.

☐ Section 7: Wings - Aerodynamic Design

ESDU 97017

Guide to wing aerodynamic design.

ESDU 98013

Aerodynamic principles of winglets.

☐ Section 8: Wings - Spanwise Loading E

SDU TD MEMO 6309

Graphical method for estimating the span wise distribution of aerodynamic center on wings in subsonic flow.

ESDU TD MEMO 6403

Method for the rapid estimation of theoretical span wise loading due to a change of incidence.

ESDU 73012

Method for predicting the pressure distribution on swept wings with subsonic attached flow.

☐ Section 9: Wings - Drag Rise, Wave Drag, Separation

ESDU 72027

Adaptation of drag-rise charts in T.D. Memor. 71019 to the mid-semi-span portion of swept and tapered planforms.

ESDU 78009

A framework relating the drag-rise characteristics of a finite wing/body combination to those of its basic aerofoil.

ESDU 87003

A method of determining the wave drag and its span wise distribution on a finite wing in transonic flow.

ESDU 91021

A method of estimating a flow breakdown boundary for aerofoils and swept wings in transonic flow.

☐ Section 10: VFP Wing Method

ESDU 02013

Full-potential (FP) method for three-dimensional wings and wing-body combinations - inviscid flow. Part 1: Principles and results.

ESDU 02014

Full-potential (FP) method for three-dimensional wings and wing-body combinations - inviscid flow. Part 2: Use of FP and related programs.

ESDU 06015

Full-potential method for three-dimensional wings and wing-body combinations - inviscid flow. Part 3: Method with improved estimates of body lift and drag contributions (FPIBE).

ESDU 06016

Full-potential method for three-dimensional wings and wing-body combinations - inviscid flow. Part 4: Evaluation of trailing-vortex drag and wave components.

ESDU 10014

Full-potential method for three-dimensional wings and wing-body combinations Part 5: Pre-processor to represent effect of fore- and aft-body shape on wing flow.

ESDU 11007

Full-potential method for three-dimensional wings and wing-body combinations Part 6: Full-potential with frozen boundary layer.

ESDU 13013

Viscous full-potential (VFP) method for three-dimensional wings and wing-body combinations. Part 1: Validation of VFP results with experiment and comparisons with other methods.

ESDU 13012

Viscous full-potential (VFP) method for three-dimensional wings and wing-body combinations. Part 2: Use of VFP and related programs.

ESDU 13014

Viscous full-potential (VFP) method for three-dimensional wings and wing-body combinations. Part 3: VFP error messages, failures and suggested remedies.

ESDU 21002

Viscous full-potential (VFP) method for three dimensional wings and wing-body combinations. Part 4: VFP analysis programs for flow breakdown and forces and loads.

☐ Section 11: Vortex Generators

ESDU 93024

Vortex generators for control of shock-induced separation. Part 1: introduction and aerodynamics.

ESDU 93025

Vortex generators for control of shock-induced separation. Part 2: guide to use of vane vortex generators.

ESDU 93026

Vortex generators for control of shock-induced separation. Part 3: examples of applications of vortex generators to aircraft.

☐ Section 12: Axisymmetric Bodies - Drag Rise

ESDU 74013

A method for estimating drag-rise Mach number at zero incidence of smooth or bumpy non-ducted axisymmetric bodies without or with fins.

☐ Section 13: Axisymmetric Forebodies - Wave Drag, Pressure Distribution

ESDU 79004

Forebodies of fineness ratio 1.0, 1.5 and 2.0, having low values of wave drag coefficient at transonic speeds.

ESDU 80008

Axial pressure coefficient distributions for forebodies of fineness ratio 1.0, 1.5 and 2.0 at zero incidence in transonic flow.

ESDU 83017

The wave drag coefficient of spherically blunted secant ogive forebodies of fineness ratio 1.0, 1.5, and 2.0 at zero incidence in transonic flow.

ESDU 83018

Axial pressure coefficient distributions for spherically blunted secant ogive forebodies of fineness ratio 1.0, 1.5 and 2.0 at zero incidence in transonic flow.

ESDU 89033

Pressure drag and lift contributions for blunted forebodies of fineness ratio 2.0 in transonic flow ($M\infty \leq 1.4$).

☐ Section 14: Axisymmetric Forecowls - Wave Drag, Pressure Distribution

ESDU 94013

NACA 1-series geometry representation for computational fluid dynamics.

ESDU 94014

Wave drag coefficient for axisymmetric forecowls at zero incidence ($M\infty \leq 1.5$).

ESDU 94015

Surface pressure coefficient distributions for axisymmetric forecowls at zero incidence ($M\infty \leq 1.5$)

☐ Section 15: Design Optimization

ESDU 99019

Constrained multivariate optimization techniques for the design of aerofoil sections

ESDU 99020

Examples of the application of constrained multivariate optimization techniques to the design of aerofoil sections. Design point: single, geometry variation: LE and TE flap deflection or camber line vars, initial aerofoil: RAE 2822.

ESDU 99021

Examples of the application of constrained multivariate optimization techniques to the design of aerofoil sections. Design point: dual, geometry variation: LE and TE flap deflection and camber line vars, initial aerofoil: RAE 2822.

ESDU 00022

Example of the application of constrained multivariate optimization techniques to the design of aerofoil sections. Design point: single, geometry var: LE and TE flaps, initial aerofoil: combat aircraft section, CFD: BVGK (viscous flow).

ESDU 00023

Examples of the application of constrained multivariate optimization techniques to the design of aerofoil sections. Design point: single, geometry var: LE and TE flaps, initial aerofoil: combat aircraft section, CFD: BVGK (inviscid), Euler code.

ESDU 01024

Example of the application of constrained multivariate optimization techniques to the design of aerofoil sections. Dual design point, upper and lower surface shape geometry, leading and trailing edge flap deflections, RAE 2822, Euler code and BVGK.

ESDU 01025

Examples of the application of constrained multivariate optimization techniques to the design of aerofoil sections. Design point: single, upper and lower surfaces geometry and camber line variations, initial aerofoil: NACA 0012 and RAE 2822, CFD: BVGK.

☐ Section 16: Surface Flow Visualization

ESDU 03014

Surface flow visualization in aircraft design.

☐ Section 17: Extrapolating Wind-Tunnel Data

ESDU 05022

Extrapolating wind-tunnel data to full-scale Reynolds number. Part 1: Principles

ESDU 07010

Extrapolating wind-tunnel data to full-scale Reynolds number Part 2: Procedures

ESDU 09015

Extrapolating wind-tunnel data to full-scale Reynolds number Part 3: Example (i) Choice of simulation criteria and transition-strip locations for the F4 Wing/Body combination at the design condition.

ESDU 11006

Extrapolating wind-tunnel data to full-scale Reynolds number Part 3: Example (ii) Comparison of extrapolated low-Reynolds-number lift measurements on the F4 wing/body with high-Reynolds-number measurements.

ESDU 09016

Use of local-flow conditions for calculation of roughness-particle height in transition strips on wings.

ESDU 14007

Selection of roughness bands to induce boundary-layer transition in wind-tunnel testing.

ESDU 12006

Method to determine surface finish required to minimize local skin friction in the presence of a turbulent boundary layer.

☐ Section 18: Wind Tunnel Interference

ESDU 95014

Upwash interference for winds in solid-liner wind tunnels using subsonic linearized theory.

☐ Section 19: Flow Measurement

ESDU 16001

A practical guide to turbulence and flow measurement by thermal anemometry (CTA), laser-Doppler anemometry (LDA) and particle-image velocimetry (PIV). Part 1: Overview and Selection of Measurement Technique.

ESDU 16002

A practical guide to turbulence and flow measurement by thermal anemometry (CTA), laser-Doppler anemometry (LDA) and particle-image velocimetry (PIV). Part 2: constant-temperature anemometry.

ESDU 17008

A practical guide to turbulence and flow measurement by thermal anemometry (CTA), laser-Doppler anemometry (LDA) and particle-image velocimetry (PIV). Part 3: laser-Doppler anemometry.

ESDU 17009

A practical guide to turbulence and flow measurement by thermal anemometry (CTA), laser-Doppler anemometry (LDA) and particle-image velocimetry (PIV). Part 4: particle-image velocimetry.

☐ Section 20: Aircraft Design

ESDU TM 207

Concept and preliminary design. Examples of applying rapid aerodynamic analysis tools to three classic historical configurations designed to similar requirement.

ESDU 21001

Guidance on the selection of aerodynamic methods to use at different stages of civil aircraft design.

Tribology

☐ Section 1: Organizational Documents

ESDU 00005

Tribology Series record of documents.

☐ Section 2: Bearing Selection

ESDU 65007

General guide to the choice of journal bearing type.

ESDU 67033

General guide to the choice of thrust bearing type.

ESDU 89044

Friction in bearings.

☐ Section 3: Rolling Bearings

ESDU 81005

Designing with rolling bearings. Part 1: design considerations in rolling bearing selection with particular reference to single row radial and cylindrical roller bearings.

ESDU 81037

Designing with rolling bearings. Part 2: selection of single row angular contact ball, tapered roller and spherical roller bearings.

ESDU 82014

Designing with rolling bearings. Part 3: special types.

☐ Section 4: Journal Bearing Calculations

ESDU 84031

Calculation methods for steadily loaded axial groove hydrodynamic journal bearings.

ESDU 85028

Calculation methods for steadily loaded axial groove hydrodynamic journal bearings. Superlaminar operation. (To be used in conjunction with ESDU 84031.)

ESDU 86008

Calculation methods for steadily loaded axial groove hydrodynamic journal bearings. Low viscosity process fluid lubrication. (To be used in conjunction with Items Nos. 84031 and 85028.)

ESDU 90027

Calculation methods for steadily loaded central circumferential groove hydrodynamic journal bearings.

ESDU 92026

Calculation methods for externally pressurised (hydrostatic) journal bearings with capillary restrictor control.

ESDU 92037

Calculation methods for externally pressurised (hydrostatic) journal bearings with capillary restrictor control. (Guide to use of computer program A9237.)

ESDU 93004

Calculation methods for steadily loaded central circumferential groove hydrodynamic journal bearings. (Guide to use of computer program A9304.)

ESDU 93005

Calculation methods for steadily loaded axial groove hydrodynamic journal bearings. (Guide to use of computer program A9305.)

ESDU 93006

Calculation methods for steadily loaded axial groove hydrodynamic journal bearings. Low viscosity process fluid lubrication. (Guide to use of computer program A9306.)

☐ Section 5: Thrust Bearing Calculations

ESDU 82029

Calculation methods for steadily loaded fixed-inclined-pad thrust bearings.

ESDU 83004

Calculation methods for steadily loaded, off-set pivot, tilting-pad thrust bearings.

ESDU 92034

Calculation methods for steadily loaded fixed-inclined-pad thrust bearings. (Guide to use of computer program A9234.)

ESDU 92035

Calculation methods for steadily loaded, off-set pivot, tilting-pad thrust bearings. (Guide to use of computer program A9235.)

☐ Section 6: Flexible Elements

ESDU 67021

The design of crossed flexure-pivots.

☐ Section 7: Temperatures in Bearings

ESDU 78026

Equilibrium temperatures in self-contained bearing assemblies; Part I: outline of method of estimation.

ESDU 78027

Equilibrium temperatures in self-contained bearing assemblies; Part II: first approximation to temperature rise.

ESDU 78028

Equilibrium temperatures in self-contained bearing assemblies. Part III: estimation of thermal resistance of an assembly.

ESDU 78029

Equilibrium temperatures in self-contained bearing assemblies. Part IV: heat transfer coefficient and joint conductance.

ESDU 79002

Equilibrium temperatures in self-contained bearing assemblies. Part V: examples of the complete method.

ESDU 97019

Equilibrium temperatures in self-contained bearing assemblies (use of computer program A9719).

☐ Section 8: Contact Stresses

ESDU 78035

Contact phenomena. I: stresses, deflections and contact dimensions for normally-loaded unlubricated elastic components.

ESDU 84017

Contact phenomena. II: stress fields and failure criteria in concentrated elastic contacts under combined normal and tangential loading.

ESDU 85007

Contact phenomena. III: calculation of individual stress components in concentrated elastic contacts under combined normal and tangential loading.

ESDU 94034

Dimensions, deflections and stresses for Hertzian contacts under combined normal and tangential loading. (Guide to use of computer program A9434.)

☐ Section 9: Lubrication

ESDU 68039

Guide to the design of tanks for forced-circulation oil-lubrication systems.

ESDU 78032

Grease life estimation in rolling bearings.

ESDU 83030

Selection of filter rating for lubrication systems.

ESDU 85027

Film thicknesses in lubricated Hertzian contacts (EHL). Part 1: two-dimensional contacts (line contacts).

ESDU 89045

Film thicknesses in lubricated Hertzian contacts. Part 2: point contacts.

ESDU 91037

Film thickness in lubricated Hertzian line contacts. (Use of computer program A9137).

ESDU 91038

Film thickness in lubricated Hertzian point contacts. (Use of computer program A9138).

ESDU 94020

Selection of synthetic oils.

ESDU 03016

Selection of lubricant class (liquids, solids, semi-solids and gases).

☐ Section 10: Seal Selection

ESDU 80012

Dynamic sealing of fluids. I: guide to selection of rotary seals.

ESDU 83031

Dynamic sealing of fluids. II: guide to selection of reciprocating seals.

☐ Section 11: Material Properties

ESDU 84041

Properties of common engineering materials.

ESDU 86040

Selection of surface treatments and coatings for combating wear of load-bearing surfaces.

☐ Section 12: Design and Material Selection

ESDU 87007

Design and material selection for dry rubbing bearings.

ESDU 88018

Selection of alloys for hydrodynamic bearings.

ESDU 96015

Design and material selection for dry rubbing bearings (use of computer program A9615).

☐ Section 13: Rotordynamics

ESDU 95023

Dynamics of a simple flexible rotor supported in axial groove hydrodynamic journal bearings. (Guide to use of computer program A9523.)

☐ Section 14: Stress and Lubrication of Disc Cams

ESDU 00015

Disc cams: tribological analysis using computer program A0015.

Vibration and Acoustic Fatigue

☐ Section 1: Organizational Documents

ESDU 00011

Vibration and Acoustic Fatigue Series: record of documents.

☐ Section 2: General

ESDU 20005

Introduction and guide to ESDU Data on acoustic fatigue.

ESDU 66013

Definitions of terms for acoustic fatigue analysis.

ESDU 66018

The relation between sound pressure level and r.m.s. fluctuating pressure.

ESDU 83035

Estimation of the stiffnesses and apparent elastic properties of laminated flat plates.

ESDU 86025

Design against fatigue: vibration of structures under acoustic or aerodynamic excitation.

ESDU 17011 (supersedes 66016)

Power spectral density and bandwidth correction of spectrum level.

ESDU 17012 (supersedes 66017)

Combination of levels in dB.

ESDU 17002

Octave and fractional-octave band filters.

ESDU 15011

Acoustics of reverberation chambers.

ESDU 21003

Decibel scales and definitions of levels.

ESDU 22001

Definitions of terms used in Vibration and Acoustic Fatigue.

☐ Section 3: Endurance under Acoustic Loading

ESDU 72015

Endurance of aluminium alloy structural elements subjected to simulated acoustic loading.

ESDU 10011

Endurance of titanium and titanium alloy structural elements subjected to simulated acoustic loading.

ESDU 84027

Endurance of fibre-reinforced composite, laminated structural elements subjected to simulated random acoustic loading.

ESDU 93027

Methods of testing for endurance of structural elements using simulated acoustic loading.

ESDU 10012

Application of linear regression analysis to acoustic fatigue data.

☐ Section 4: Loading Actions

ESDU 18011

Cavity oscillations.

ESDU 72002

The estimation of near-field sound pressure levels due to jet noise.

ESDU 74033

Estimation of sound pressure levels due to buzz-saw noise within the intake duct of a supersonic fan or compressor.

ESDU 75021

Estimation of the surface pressure fluctuations in the turbulent boundary layer of a flight vehicle.

ESDU TM 58

ESDU TECHNICAL MEMORANDUM
Comparison of surface pressure fluctuations in a turbulent boundary layer as measured on various flight vehicles.

ESDU 99006

Computer-based estimation procedure for near-field single-stream jet noise.

ESDU 11005

Prediction of near-field and far-field harmonic noise from subsonic propellers with non-axial inflow.

☐ Section 5: Stress-Strain Response to Acoustic Loading

ESDU 67028

Estimation of the r.m.s. stress in skin panels subjected to random acoustic loading.

ESDU 67029

The effect of edge reinforcement on the stresses in skin panels under uniform pressure.

ESDU 72005

The estimation of r.m.s. stress in stiffened skin panels subjected to random acoustic loading.

ESDU 72017

Stress response of flat or singly-curved sandwich panels with cores of zero flexural stiffness subjected to random acoustic loading.

ESDU 73014

The estimation of r.m.s. stress in skin panels with flexible stiffeners subjected to random acoustic loading.

ESDU 74026

Estimation of r.m.s. stress in internal plates of a box structure subjected to random acoustic loading.

ESDU 84008

Estimation of r.m.s. strain in laminated skin panels subjected to random acoustic loading.

ESDU 86024

Estimation of r.m.s. strain in laminated face plates of simply-supported sandwich panels subjected to random acoustic loading. Including a simplified natural frequency prediction method.

ESDU 95026

Edge effects on the response of sandwich panels subjected to acoustic loading.

☐ Section 6: Natural Frequencies of Plate and Shell Structures

ESDU 72003

Natural frequencies of built-up, flat, periodic skin-stringer structures. Part I: stringers rigid in bending.

ESDU 73013

Reference frequency of panel with flexible stiffeners.

ESDU 75030

Natural frequencies of rectangular flat plates with various edge conditions.

ESDU 83036

Natural frequencies of rectangular, specially orthotropic laminated plates.

ESDU 87002

Natural frequencies of rectangular singly-curved plates.

ESDU 89011

Natural frequencies of singly-curved laminated plates with simply-supported edges.

ESDU 90016

Natural frequencies of isotropic and orthotropic rectangular plates under static in-plane loading (including shear loading).

ESDU TM 71

ESDU TECHNICAL MEMORANDUM
A Rayleigh-Ritz method of analysis for vibration of orthotropic plates under static in-plane loading (including shear).

ESDU 78004

Natural frequencies of thin-walled isotropic, circular-cylindrical shells.

ESDU 80040

Free vibration of thin-walled, orthogonally stiffened, circular-cylindrical shells.

ESDU 81018

Natural frequencies of thick-walled isotropic circular-cylindrical shells (shear diaphragm end conditions).

☐ Section 7: Natural Frequencies of Sandwich Panels and Box Structures

ESDU 72016

Natural frequencies of flat or singly-curved sandwich panels with cores of zero flexural stiffness.

ESDU 74025

Natural frequencies of box structures.

ESDU 85037

Natural frequencies of simply-supported sandwich panels with laminated face plates.

☐ Section 8: Analysis of the Dynamic Response of Structures

ESDU 97033

Methods for analysis of the dynamic response of structures.

ESDU 99009

An introduction to Statistical Energy Analysis.

ESDU 98020

Estimation of transmission efficiencies of coupled plates.

ESDU 00002

Sound power radiation from isotropic plates.

ESDU 02009

Sound radiation from orthotropic rectangular plates. Part I: estimation by asymptotic method.

ESDU 02010

Sound radiation from orthotropic rectangular plates. Part II: validation by comparison with numerical and experimental results.

ESDU 04009

Mobilities and impedances of structures. Part 1: Compendium of frequency response functions.

ESDU 04010

Mobilities and impedances of structures. Part 2: Compendium of point mobilities of infinite structures.

ESDU 11008

Compendium of modal densities. Part 1: rods, beams and plates.

ESDU 11009

Compendium of modal densities Part II: Shell structures

ESDU 13003

Modal density of acoustic spaces.

ESDU 15010

Coupling loss factors.

ESDU 19006

Force limited random vibration testing – The computation of the semi-empirical constant C2 for the test article and supporting structure.

☐ Section 9: Estimation of Fatigue Life of Structures Subjected to Random Loading

ESDU 06009

Fatigue damage and life under random loading.

ESDU 06010

Cycle counting methods for the estimation of fatigue life.

ESDU 06011

Spectral methods for the estimation of fatigue life.

ESDU 07012

Crack growth criteria for the estimation of fatigue life.

☐ Section 10: Damping

ESDU 09005

Introduction to Damping.

ESDU 73011

Damping in acoustically excited structures.

ESDU 85012

Estimation of damping in laminated and fibre-reinforced plates.

ESDU 91012

Methods for improving damping.
Part 1: an introduction and guide to practical methods of increasing structural damping.

ESDU 91013

Methods for improving damping.
Part 2: layered damping treatment for structures: analysis and examples.

ESDU 92001

Methods for improving damping.
Part 3: damping material data.

ESDU 07011

Damping of structural vibrations by acoustic radiation.

ESDU 09006

Material Damping.

ESDU TM 173

ESDU TECHNICAL MEMORANDUM
Material damping of metals and alloys.

ESDU TM 183

ESDU TECHNICAL MEMORANDUM
Compendium of vibration damping data for aerospace structures.

Wind Engineering

☐ Section 1: Organizational Documents

ESDU 02011

Wind Engineering Series organization: preface, volumes, location schedule, amendment record.

ESDU CFA

Conversion factors.

☐ Section 2: Wind Speeds and Turbulence - Mean Hourly and Gust Speeds, Extreme Speeds, Turbulence Characteristics

ESDU 82026

Strong winds in the atmospheric boundary layer.
Part 1: hourly-mean wind speeds.

ESDU 83045

Strong winds in the atmospheric boundary layer.
Part 2: discrete gust speeds.

ESDU 74030

Characteristics of atmospheric turbulence near the ground. Part I: definitions and general information.

ESDU 85020

Characteristics of atmospheric turbulence near the ground. Part II: single point data for strong winds (neutral atmosphere).

ESDU 86010

Characteristics of atmospheric turbulence near the ground. Part III: variations in space and time for strong winds (neutral atmosphere).

ESDU 87034

World-wide extreme wind speeds.
Part 1: origins and methods of analysis.

ESDU 88037

World-wide extreme wind speeds. Part 2: examples using various methods of analysis.

ESDU 88038

Estimation of hours per year when mean wind speed exceeds specified thresholds.

☐ Section 3: Wind Speeds and Turbulence - Effect of Terrain Roughness and Local Topography

ESDU 84011

Wind speed profiles over terrain with roughness changes.

ESDU 84030

Longitudinal turbulence intensities over terrain with roughness changes.

ESDU 86035

Integral length scales of turbulence over flat terrain with roughness changes.

ESDU 91043

Mean wind speeds over hills and other topography.

ESDU 01008

Computer program for wind speeds and turbulence properties: flat or hilly sites in terrain with roughness changes.

ESDU 97031

Estimation of shelter provided by solid and porous fences.

☐ Section 4: Mean Loads on Structures - Single Circular and Multi-Sided Cylinders, Cylinder Groups

ESDU 71012

Fluid forces on non-streamline bodies - background notes and description of the flow phenomena.

ESDU 80025

Mean forces, pressures and flow field velocities for circular cylindrical structures: single cylinder with two-dimensional flow.

ESDU 81017

Mean forces, pressures, and moments for circular cylindrical structures: finite-length cylinders in uniform and shear flow.

ESDU 79026

Mean fluid forces and moments on cylindrical structures: polygonal sections with rounded corners including elliptical shapes.

ESDU 84015

Cylinder groups: mean forces on pairs of long circular cylinders.

☐ Section 5: Mean Loads on Structures - Rectangular-Section Cylinders, Paraboloidal Antennas, Wind-Tunnel Blockage

ESDU 71016

Fluid forces, pressures and moments on rectangular blocks.

ESDU 80003

Mean fluid forces and moments on rectangular prisms: surface-mounted structures in turbulent shear flow.

ESDU 80024

Blockage corrections for bluff bodies in confined flows.

ESDU 82031

Paraboloidal antennas: wind loading. Part 1: mean forces and moments.

ESDU 83020

Paraboloidal antennas: wind loading. Part 2: surface pressure distribution.

ESDU 89050

Boundary walls, fences and hoardings: mean and peak wind loads and overturning moments.

☐ Section 6: Mean Loads on Structures - Lattice Frames and Towers, Beams of Various Sections

ESDU 81027

Lattice structures. Part 1: mean fluid forces on single and multiple plane frames.

ESDU 81028

Lattice structures. Part 2: mean fluid forces on tower-like space frames.

ESDU 82007

Structural members: mean fluid forces on members of various cross sections.

☐ Section 7: Dynamic Response - Background, Turbulence Buffeting

ESDU 77032

Fluctuating loads and dynamic response of bodies and structures in fluid flows - background information.

ESDU 87035

Calculation methods for along-wind loading. Part 2. Response of line-like structures to atmospheric turbulence.

ESDU 88019

Calculation methods for along-wind loading. Part 3. Response of buildings and plate-like structures to atmospheric turbulence.

ESDU 92036

Response of structures to atmospheric turbulence. Computer programs A9236 and B9236.

☐ Section 8: Dynamic Response - Across-Wind Buffeting, Vortex Shedding (Non-Circular Sections), Galloping

ESDU 89049

Response of structures to atmospheric turbulence. Response to across-wind turbulence components.

ESDU 90036

Structures of non-circular cross section: dynamic response due to vortex shedding.

ESDU 91010

Response of structures to galloping excitation. Background and approximate estimation.

ESDU 93013

'Lift-curve slope' for structural response calculations.

☐ Section 9: Dynamic Response - Vortex Shedding and Turbulence (Single Circular Section), Cylinder Groups

ESDU 79025

Fluctuating response of circular cylinders in small groups in fluid flow - discussion and guide to data available.

ESDU 96030

Response of structures to vortex shedding. Structures of circular or polygonal cross section.

ESDU 96031

Computer programs for response of structures to vortex shedding. Structures of circular or polygonal cross section. Part 1. Microsoft Excel module.

☐ Section 10: Natural Vibration Parameters of Structures - Core, Shear, Frame Buildings, Towers, 2D Frameworks

ESDU 79005

Undamped natural vibration of shear buildings.

ESDU 81036

Undamped natural vibration of core buildings.

ESDU 82019

Undamped natural vibration of sway frame buildings and frame structures.

ESDU 83009

Damping of structures. Part 1: tall buildings.

ESDU 91001

Structural parameters used in response calculations. Estimation of numerical values.

Aerodynamics

Group Head - Stephen Woods

ESDUpac Name	ESDUpac Version	ESDUpac Title
A0025	1.2	Prediction of aircraft lateral stability derivatives in sideslip at subsonic speeds
A0107	1.1	Computer program for estimation of trailing vortex drag factors for wings with part-span trailing-edge plain flaps
A020302	1.0	Calculation of optimum area distribution and associated minimum theoretical transonic drag-rise for aircraft at zero lift
A0620	1.0	Computer program for estimation of aerofoil characteristics at subcritical speeds: lift-curve slope, zero-lift incidence and pitching moment, aerodynamic centre and drag polar minimum
A1023	1.2	Computer program for calculation of equivalent straight-tapered wing planform
A1309	1.0	Computer program for calculation of aerodynamic centre of wing-fuselage-nacelle combinations
A1309	1.0	Computer program for calculation of aerodynamic centre of wing-fuselage-nacelle combinations
A1309	1.0	Computer program for calculation of aerodynamic centre of wing-fuselage-nacelle combinations
A1309	1.0	Computer program for calculation of aerodynamic centre of wing-fuselage-nacelle combinations
A7011	2.4	Lift-curve slope and aerodynamic centre position of wings in inviscid subsonic flow
A7012	1.3	Lift-curve slope and aerodynamic centre position of wings in inviscid supersonic flow
A7106	1.0	Low-speed longitudinal aerodynamic characteristics of slender wings
A7107	1.0	Low-speed normal force and pitching moment of slender wings in ground effect
A7223	1.0	Computer program for calculation of low-speed longitudinal aerodynamic characteristics of aircraft in ground effect
A7435	1.1	Subsonic lift-dependent drag due to the trailing vortex wake for wings without camber or twist
A7436	1.3	Estimation of drag due to a circular cavity in a plate with turbulent boundary layer at subsonic, transonic or supersonic speeds
A7528	1.4	Estimation of the drag due to grooves in a flat plate with a turbulent boundary layer at subsonic and supersonic speeds
A7531	1.5	Estimation of drag of two-dimensional steps and ridges in a turbulent boundary layer for Mach numbers up to 3
A7728	1.1	Calculation of geometrical characteristics of typical bodies
A7819	1.1	Calculation of Profile Drag of Axisymmetric Bodies at Zero Incidence for Subcritical Mach Numbers (Method of Addendum A)
A8020	1.2	Calculation of average downwash at the tailplane at low angles of attack and subsonic speeds
A8114	1.0	Computer program for estimation of contribution of wing planform to derivatives of yawing moment and sideforce due to roll rate at subsonic speeds, (Np)w and (Yp)w

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8123	2.0	Program for calculation of lift and drag of two staggered lifting surfaces at low speeds.
A8124	1.1	Drag of axisymmetric cowls at zero incidence for subsonic Mach numbers.
A8234	1.0	Computer program for calculation of aircraft forces due to interference between a jet efflux and a slotted flap
A8310	2.1	Calculation of oscillatory aerodynamics data for slender bodies.
A8510	1.0	Calculation of the roots of the characteristic equations for controls-fixed longitudinal and lateral stability of aircraft
A8621	1.0	Calculation of the roots of the characteristic equations for controls-fixed longitudinal and lateral stability of aircraft
A8701	1.1	Wing pitching moment at zero lift at subcritical Mach numbers
A8705	1.2	Increment in aerofoil profile drag due to the deployment of a single-slotted flap
A8708	1.7	Calculation of Rudder Sideforce, Yawing Moment and Rolloing Moment Control Derivatives at Low Speeds: Y sub zeta, N sub zeta and L sub zeta
A8724	1.2	Low-speed drag coefficient increment at constant lift due to full-span plain flaps
A8731	1.0	Wing angle of attack for zero lift at subcritical Mach numbers
A8831	1.0	Computer program for ESDU 88031: Lift and longitudinal forces on propeller/nacelle/ wing/flap systems
A8840	4.2	Calculation of aileron rolling moment and yawing moment coefficients at subsonic speeds
A8929	1.0	Computer program for calculation of installed tailplane lift-curve-slope at subsonic speeds
A8942	1.1	Computer program for calculation of body effect on wing angle of attack and pitching moment at zero lift at low speeds
A8947	1.0	Calculation of in-plane force and moment derivatives for inclined propellers at low forward speeds
A9005	1.3	First resonance frequency for ventilated wind tunnels operating at subsonic speeds
A9010	1.3	Calculation of pitching moment and lift force derivatives due to rate of pitch for aircraft at subsonic speeds
A9020	1.1	Calculation of airframe-induced upwash at subsonic speeds
A9034	5.1	Calculation of normal force and pitching moment of forebody-cylinder combinations at angles of attack up to 90 degrees and Mach numbers up to 5, including effects of conical boat-tailing
A9109	1.0	Estimation of effect of twin fins on isolated tailplane lift-curve slope
A9128	2.0	Program for calculation of lift and drag of two staggered lifting surfaces at low speeds
	1.1	Simplified method for the prediction of aerofoil excrescence drag magnification factor for turbulent boundary layers at subcritical Mach numbers
A9315	2.1	Maximum lift coefficient of plain aerofoils and wings at subsonic speeds
A9438	1.3	Estimation of leading-edge suction distribution for plane thin wings at subsonic speeds
A9510	1.3	Computer program for estimation of spanwise loading of wings with camber and twist in subsonic attached flow
A9510	1.3	Computer program for estimation of spanwise loading of wings with camber and twist in subsonic attached flow

Aircraft Noise

Group Head - Martin Doherty

ESDUpac Name	ESDUpac Version	ESDUpac Title
A9625	6.0	Drag due to lift for non-planar swept wings up to high angle of attack at subsonic speeds.
A9626	1.0	Calculation of drag and yawing moment due to spoilers
A9721	1.3	Calculation of the effect of trailing-edge flap deployment on average downwash at the tailplane at low speeds
A9931	2.4	Computer program for estimation of lift curve for wing-fuselage combinations with high-lift devices at low speeds
AC811	1.0	Computer Program for ESDU Aero C.08.01.01: Rate Of Change Of Pitching Moment Coefficient With Control Deflection For A Plain Control In Incompressible Two-Dimensional Flow, m0
AF218	1.1	Vortex drag coefficient of wing with part-span flap and central cut-out
B9510	1.1	Computer program for estimation of spanwise loading of wings with camber and twist in subsonic attached flow. Lifting-surface theory. (With Appendix A: effect of plain flaps)
B9903	1.0	Generation of GUNACA 23 series of low-drag aerofoils (screen prompt version)
B9931	2.1	Computer program for estimation of spanwise position of peak loading
A0012	4.0	Circular duct liner attenuation
A0024	1.1	Rectangular and annular duct liner attenuation
A0115	1.0	Far-field sound radiation from circular ducts
A0411	1.1	Sound attenuation in a refracting turbulent atmosphere
A0501	1.0	Combustor noise
A0701	2.0	Noise transmission into aircraft cabins
A0818	1.0	Common Data File Processor
A1102	1.1	Coaxial Jet Noise Prediction
A1105	1.2	Propeller noise in non-axial inflow
A1201	1.0	Turbine Noise Prediction
A1301	1.0	Shock noise prediction
A1414	1.1	Static-to-flight effects on coaxial jet noise
A7520	3.0	Far-field buzz-saw noise
A7521	3.2	Turbulent boundary layer noise
A7620	1.0	Rotor and propeller noise
A7802	2.0	Discrete frequency atmospheric attenuation of sound
A7803	3.0	Estimation of the attenuation of broad-band sound by a non-uniform still atmosphere
A7911	3.0	Estimation of noise shielding by barriers
A8227	2.0	Estimation of lateral attenuation
A8711	3.0	Static-to-flight correction of far-field single-stream jet noise
A8936	2.2	Outdoor sound propagation in wind and temperature gradients
94036	1.1	Overground sound attenuation

ESDUpac Name	ESDUpac Version	ESDUpac Title
A9023	4.0	Airframe noise prediction
A9435	2.1	Ground reflection correction
A9436	1.1	Overground sound attenuation
A9627	1.2	Estimation of the unsteady lift coefficient of subsonic propeller blades in non-axial inflow
A9808	4.0	Fan noise prediction
A9819	2.2	Single-stream jet noise prediction
A9906	2.0	Near-field single-stream jet noise prediction
B0012	2.0	Generation of input file for circular duct liner attenuation prediction
B0024	1.0	Generation of input file for rectangular and annular duct liner attenuation prediction

Composites

Group Head - Adam Quilter

ESDUpac Name	ESDUpac Version	ESDUpac Title
B0115	1.0	Generation of input file for prediction of far-field radiation from ducts
B0411	1.0	Generation of input file for sound propagation fast field program
B0501	1.0	Generation of input file for prediction of combustor noise
B0701	2.0	Noise transmission into aircraft cabins
B1102	1.1	Coaxial Jet Noise Prediction
B1105	1.0	Generation of input file for prediction of propeller noise
B1201	1.0	Input file generation for turbine noise prediction
B1301	1.0	Input file generation for shock noise prediction
B1414	1.0	Generation of input file for far-field coaxial jet noise prediction in flight
B7520	1.0	Generation of input file for prediction of buzz-saw noise
B7620	1.0	Generation of input file for prediction of rotor and propeller noise
B7803	1.0	Generation of input file for prediction of broad-band atmospheric attenuation
B7911	1.0	Generation of input file for prediction of noise shielding by barriers
B8711	3.0	Static-to-flight correction of far-field single-stream jet noise
B9023	1.0	Generation of input file for prediction of airframe noise
B9435	1.0	Ground reflection correction
B9436	1.0	Generation of input file for sound attenuation program
B9808	1.1	Generation of input file for prediction of fan noise
B9819	2.1	Single-stream jet noise prediction
B9906	2.0	Near-field single-stream jet noise prediction
C0701	2.0	Noise transmission into aircraft cabins
C1102	1.0	Coaxial Jet Noise Prediction

ESDUpac Name	ESDUpac Version	ESDUpac Title
C9819	2.1	Formatting the single-stream jet noise database
C9906	2.0	Near-field single-stream jet noise prediction
D0701	1.0	Estimation of section properties of fuselage stiffeners
Wing	1.0	Wing reflection effects on jet noise from under-wing engines
A0301	2.0	Elastic buckling of long, flat, symmetrically-laminated (AsBoDf), composite stiffened panels and struts in compression
A0313	1.1	Thickness selection for the flanges and web of a composite I-section beam subjected to bending and shear

Dynamics

Group Head - Adam Quilter

ESDUpac Name	ESDUpac Version	ESDUpac Title
A7916	2.1	Inelastic shear stresses and strains in the adhesives bonding lap joints loaded in tension or shear

Fatigue - Endurance Data

Group Head - Adam Quilter

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8039	1.0	Elastic adhesive stresses in multistep lap joints loaded in tension
A8147	4.1	Buckling of flat rectangular plates
A8335	4.3	Estimation of the stiffnesses and apparent elastic properties of laminated flat plates

Fluid Mechanics, Internal Flow

Group Head - David Philpott

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8336	3.1	Natural frequencies of laminated flat plates
A8408	2.0	R.m.s strain in laminated skin panels under acoustic loading
A8418	6.1	Failure analysis of fibre reinforced composite laminates
A8501	2.2	Elastic stress and strain distributions around circular holes in infinite plates of orthotropic material
A8512	4.1	Damping in laminated and fibre-reinforced plates
A8537	3.3	Vibration of sandwich panels with laminated face plates

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8624	1.5	Response of sandwich panels with laminated face plates to acoustic loading
A8713	2.3	Elastic wrinkling of sandwich columns and beams with unbalanced laminated fibre reinforced face plates
A8815	1.2	Elastic wrinkling of sandwich panels with laminated fibre reinforced face plates.
A8911	1.2	Vibration of singly-curved laminated plates (all edges simply-supported)
A8913	1.2	Transverse (through-the-thickness) shear stiffnesses of fibre reinforced composite laminated plates
A9016	1.2	Vibration of isotropic and orthotropic rectangular plates under static in-plane loading (including shear loading)
A9103	1.1	Delamination of tapered composites
A9311	1.1	Flat rectangular orthotropic plates under uniformly distributed normal pressure

Fluid Mechanics, Internal Flow (Aerospace)

Group Head - Dave Philpott

A9405	1.1	Buckling of flat rectangular orthotropic plates
A9406	1.1	Elastic buckling of unbalanced laminated fibre reinforced plates. (Rectangular plates of AsBtDs type, all edges simply-supported under biaxial loading.)
A9407	1.1	Elastic buckling of cylindrically curved fibre reinforced composite panels with all edges simply-supported under biaxial loading
A9419	1.0	Through-the-thickness stresses and failure in the corner radius of a laminated composite section
A9528	1.0	Delamination and free edge stresses in composite laminates subjected to uniform prescribed axial strain and temperature change
A9636	1.1	Design of laminated plates subjected to in-plane loads and bending moments

Mechanisms

Group Head - Adam Quilter

B0301	1.1	Elastic buckling of long, flat, symmetrically-laminated (AsBoDf), composite stiffened panels and struts in compression
B9636	1.0	Design of laminated plates subjected to in-plane loads and bending moments
A8237	2.2	The response of two-degree-of-freedom systems
A8546	2.1	An adaptive quadrature method for the evaluation of single and double integrals
A9316	1.1	Computer program for the parameter estimation of linear systems from frequency response measurements

ESDUpac Name	ESDUpac Version	ESDUpac Title
A9141	1.1	The statistical analysis of data from Normal distributions, with particular reference to small samples
A9330	1.5	Ejectors and jet pumps. Design and performance for liquid flow
A9724	1.0	Derivation of endurance curves from fatigue test data, including run-outs
A0116	1.0	Pressure losses in flow through a sudden contraction of duct area
A0312	1.1	Estimation of mean value parameters for spatially non-uniform internal flows
A6627	1.1	Friction losses for fully-developed flow in straight pipes
A7429	2.1	Friction losses for fully-developed flow in straight pipes of constant cross section - subsonic compressible flow of gases

Performance
Group Head - Peter Wong

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8209	1.3	Compressible flow of gases. Pressure losses and discharge coefficients of orifice plates, perforated plates and thick orifice plates in ducts

Stress Analysis
Group Head - Adam Quilter

A8337	1.1	Pressure losses in curved ducts: single bends. Computer program calculating frictional losses for incompressible flow in circular section bends
A8615	2.3	Fluid transients in pipes. Estimation of maximum pressures and forces in steam lines
A8727	2.7	Fluid transients in liquid-filled pipeline networks
A8814	2.0	Prediction of air lift pump performance
A8822	3.2	Pipeline vibrations. Undamped natural vibration in non-rigid, planar piping systems
A8930	2.3	Pipeline vibrations. Fluid transients in non-rigid, unbranched planar piping systems
A9125	1.0	Non-Newtonian fluids. Friction pressure loss prediction for fully-developed flow in straight pipes. Method of Dodge and Metzner
A9242	2.0	Ejectors and jet pumps. Design and performance for compressible gas flow
A9322	1.5	Ejectors and jet pumps. Design and performance for liquid flow

Aerospace Structures
Group Head - Adam Quilter

A9331	1.1	Fluid transients in non-rigid, unbranched three-dimensional piping systems
A9446	1.0	Ejectors and jet pumps. Design and performance for steam/gas flow
B9125	1.1	Non-Newtonian fluids. Friction pressure loss prediction for fully-developed flow in straight pipes. Method of Bowen
A0116	1.0	Pressure losses in flow through a sudden contraction of duct area
A0312	1.1	Estimation of mean value parameters for spatially non-uniform internal flows
A6627	1.1	Friction losses for fully-developed flow in straight pipes
A7429	2.1	Friction losses for fully-developed flow in straight pipes of constant cross section - subsonic compressible flow of gases
A8209	1.3	Compressible flow of gases. Pressure losses and discharge coefficients of orifice plates, perforated plates and thick orifice plates in ducts
A8337	1.1	Pressure losses in curved ducts: single bends. Computer program calculating frictional losses for incompressible flow in circular section bends
A9242	2.0	Ejectors and jet pumps. Design and performance for compressible gas flow
A9322	1.5	Ejectors and jet pumps. Design and performance for liquid flow
A9446	1.0	Ejectors and jet pumps. Design and performance for steam/gas flow
A0605	1.0	Kinematic analysis of disc cams
A8626	3.1	Evaluation of the coefficients of a minimum-order polynomial cam law
A9007	1.0	Design of counterweights for balancing planar linkages
A9022	2.0	Kinetostatic force analysis of four-bar planar linkages
A9126	4.0	Analysis of cam roller followers
A9205	1.3	Minimum size of disc cams with radial translating roller followers
A9214	2.0	Blending profiles of disc cams with radial translating roller followers to reduce segment angle, reduce reference circle radius or increase follower lift
A9301	4.0	Contact stress in disc cams with roller followers
A9302	2.0	Blending profiles of disc cams with radial translating roller followers to satisfy one follower displacement precision point
A9408	3.0	Lubricant film thickness between cams and followers
A9411	3.0	Contact stress in disc cams with domed or flat-faced followers
A9434	1.1	Dimensions, deflections and stresses for Hertzian contacts under combined normal and tangential loading
A9501	2.0	Kinematic analysis of disc cams
A9611	1.2	Design of Geneva mechanisms
B9302	2.0	Blending profiles of disc cams with radial translating roller followers to satisfy one constant follower velocity component
A8825	1.0	Thermodynamic properties of air in equilibrium
APP	2.3	ESDU Aircraft Performance Program (APP)
A6803	1.1	Shafts with interference-fit collars
A6804	1.1	Shafts with interference-fit collars

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8521	1.1	Analysis of pretensioned bolted joints subject to tensile (separating) forces
A8952	3.1	Construction of inelastic stress-strain curves from minimal materials data
A9108	1.0	Lugs under axial tensile loading: tensile rupture factor
A9141	1.1	The statistical analysis of data from Normal distributions, with particular reference to small samples
A9241	2.0	Stress analysis of single lap bonded joints

Transonic Aerodynamics
Group Head - Dave Philpott

ESDUpac Name	ESDUpac Version	ESDUpac Title
A9330	1.2	Three dimensional stress concentration factors. Plain or countersunk hole in a wide plate subjected to tension, bending or pin loading
A9433	1.1	Flat rectangular isotropic plates under uniformly distributed normal pressure. Elastic stresses and deflections for various forms of edge restraint
A9724	1.0	Derivation of endurance curves from fatigue test data, including run-outs
A0101	1.2	Plastic buckling of flat isotropic stiffened panels and struts in compression
A0205	1.0	Flat panels in shear - post-buckling analysis
A0301	1.1	Elastic buckling of long, flat, symmetrically-laminated (AsBoDf), composite stiffened panels and struts in compression

Tribology
Group Head - Adam Quilter

ESDUpac Name	ESDUpac Version	ESDUpac Title
A0313	1.1	Thickness selection for the flanges and web of a composite I-section beam subjected to bending and shear
A6803	1.1	Shafts with interference-fit collars
A7616	1.0	Generalised stress-strain curves. Calculation of stress corresponding to a strain or an f/Et ratio
A7916	2.1	Inelastic shear stresses and strains in the adhesives bonding lap joints loaded in tension or shear
A8039	1.0	Elastic adhesive stresses in multistep lap joints loaded in tension.
A8147	4.1	Buckling of flat rectangular plates
A8147	4.1	Buckling of flat rectangular plates
A8418	6.1	Failure analysis of fibre reinforced composite laminates
A8501	2.2	Elastic stress and strain distributions around circular holes in infinite plates of orthotropic material
A8521	1.1	Analysis of pretensioned bolted joints subject to tensile (separating) forces

Vibration and Acoustic Fatigue
Group Head - Martin Doherty

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8713	2.3	Elastic wrinkling of sandwich columns and beams with unbalanced laminated fibre reinforced face plates
A8815	1.2	Elastic wrinkling of sandwich panels with laminated fibre reinforced face plates
A8835	1.3	Maximum inelastic bending moments and form factors for symmetric bending of beams
A8913	1.2	Transverse (through-the-thickness) shear stiffnesses of fibre reinforced composite laminated plates
A9004	3.2	Maximum inelastic bending moments and end loads (in fixed ratio) for beam sections of general polygonal shape
A9026	2.2	Inelastic bending moments, end loads, stresses and strains for beam sections of general polygonal shape
A9103	1.1	Delamination of tapered composites
A9108	1.0	Lugs under axial tensile loading: tensile rupture factor
A9141	1.1	The statistical analysis of data from Normal distributions, with particular reference to small samples
A9311	1.1	Flat rectangular orthotropic plates under uniformly distributed normal pressure
A9330	1.2	Three dimensional stress concentration factors. Plain or countersunk hole in a wide plate subjected to tension, bending or pin loading
A9405	1.1	Buckling of flat rectangular orthotropic plates
A9406	1.1	Elastic buckling of unbalanced laminated fibre reinforced plates. (Rectangular plates of AsBtDs type, all edges simply-supported under biaxial loading.)
A9407	1.1	Elastic buckling of cylindrically curved fibre reinforced composite panels with all edges simply-supported under biaxial loading
A9419	1.0	Through-the-thickness stresses and failure in the corner radius of a laminated composite section
A9528	1.0	Delamination and free edge stresses in composite laminates subjected to uniform prescribed axial strain and temperature change
A9636	1.1	Design of laminated plates subjected to in-plane loads and bending moments
A9812	1.0	Flexibility of, and load distribution in, multi-bolt lap joints subject to in-plane axial loads
A9816	1.2	Elastic buckling of flat isotropic stiffened panels and struts in compression
B0101	1.2	Plastic buckling of flat isotropic stiffened panels and struts in compression
B0301	1.1	Elastic buckling of long, flat, symmetrically-laminated (AsBoDf), composite stiffened panels and struts in compression
B9002	1.3	Struts: strength under flexural, local and inter-rivet buckling
B9636	1.0	Design of laminated plates subjected to in-plane loads and bending moments
B9816	1.2	Elastic buckling of flat isotropic stiffened panels and struts in compression
S1119	1.0	Local buckling of rectangular section struts

Wind Engineering
Group Head - Adam Quilter

ESDUpac Name	ESDUpac Version	ESDUpac Title
A8703	2.1	A method of determining the wave drag and its spanwise distribution on a finite wing in transonic flow
A9514	1.0	Upwash interference for wings in solid-liner wind tunnels using subsonic linearised-theory
contourbody	1.0	A program to generate Mach number contours around a body

Toolbox App

Series	Toolbox App Name	Version	Title
Aerodynamics	74036	1.2	ESDU 74036: Drag due to a circular cavity in a plate with a turbulent boundary layer at subsonic, transonic and supersonic speeds
Aerodynamics	75028	1.2	ESDU 75028: Drag due to grooves in a flat plate with turbulent boundary layer, at subsonic and supersonic speeds
Aerodynamics	75031	1.3	ESDU 75031: Drag of two-dimensional steps and ridges immersed in a turbulent boundary layer for Mach numbers up to 3
Aerodynamics	Aero A.02.03.02	1.0	Calculation of optimum area distribution and associated minimum theoretical transonic drag-rise for aircraft at zero lift
Aerodynamics	ASTEROID	1.0	Aircraft Surface Tolerances for Enhanced Repair, Operations and Design
Aerodynamics	ASTEROID fp	1.0	Aircraft Surface Tolerances for Enhanced Repair, Operations and Design - Flat Plate
Aerodynamics	CFM	1.1	Local and mean skin friction coefficients on a flat plate
Aerodynamics	ISA	1.1	International Standard Atmosphere app
Aerodynamics	TM 169	1.1	Wing lift-curve slope app
Fatigue - Fracture Mechanics	20003	1.0	ESDU 20003: Crack Resistance Curves
Performance	ASTEROID	1.0	Aircraft Surface Tolerances for Enhanced Repair, Operations and Design
Performance	ASTEROID fp	1.0	Aircraft Surface Tolerances for Enhanced Repair, Operations and Design - Flat Plate
Performance	ISA	1.1	International Standard Atmosphere app
Stress and Strength	89052	1.1	Inelastic stress-strain curves from ESDU 89052
Structures	89052	1.1	Inelastic stress-strain curves from ESDU 89052

VIEWpacs

Series	VIEWpac	VIEWpac Version	VIEWpac Title
Aircraft Noise	M0012	1.1	Matlab: Circular duct liner attenuation
Aircraft Noise	M0024	1.0	Matlab: Rectangular and annular duct liner attenuation
Aircraft Noise	M0115	1.0	Matlab: Far-field sound radiation from circular ducts
Aircraft Noise	M0411	1.0	Matlab: Sound attenuation in a refracting turbulent atmosphere
Aircraft Noise	M0501	1.1	Matlab: Combustor Noise
Aircraft Noise	M0818	1.1	Matlab: Common Data File Processor
Aircraft Noise	M1102	1.1	Matlab: Coaxial Jet Noise Prediction
Aircraft Noise	M1105	1.0	Matlab: Propeller noise in non-axial inflow
Aircraft Noise	M1201	1.3	Matlab: Turbine Noise Prediction
Aircraft Noise	M1301	1.2	Matlab: Shock noise prediction
Aircraft Noise	M1414	1.1	Matlab: Static-to-flight effects on coaxial jet noise
Aircraft Noise	M7520	1.0	Matlab: Generation of input file for prediction of buzz-saw noise
Aircraft Noise	M7521	1.0	Matlab: Turbulent boundary layer noise
Aircraft Noise	M7620	1.0	Matlab: Rotor and propeller noise
Aircraft Noise	M7802	1.0	Matlab: Discrete frequency atmospheric attenuation of sound
Aircraft Noise	M7803	1.0	Matlab: Estimation of the attenuation of broad-band sound by a non-uniform still atmosphere
Aircraft Noise	M7911	1.0	Matlab: Estimation of noise shielding by barriers
Aircraft Noise	M8823	1.0	Matlab: Jet-by-jet shielding of noise
Aircraft Noise	M9023	1.0	Matlab:Airframe noise prediction
Aircraft Noise	M9435	1.0	Matlab: Ground reflection correction
Aircraft Noise	M9808	1.1	Matlab: Prediction of noise generated by fans and compressors in turbojet and turbofan engines
Aircraft Noise	M9819	1.2	Matlab: Single-stream Jet Noise Prediction
Aircraft Noise	M9906	1.0	Matlab: Near-field single-stream jet noise
Aircraft Noise	MG1105	1.0	Matlab: Plotting of noise spectra
Aircraft Noise	MG1414	1.0	Matlab: Plotting of noise spectra
Aircraft Noise	plotcontour	1.0	Matlab: Contour plotting program for wing reflection effects
Fatigue - Endurance Data	E0419	1.1	Endurance of high-strength steels
Fatigue - Endurance Data	e1901	1.0	Fatigue of wrought and cast titanium alloys in bending and under axial loading
Fatigue - Endurance Data	e1902	1.0	Fatigue of wrought and cast Ti-6Al-4V alloys
Fatigue - Endurance Data	FSTAF	1.0	FALSTAFF Standard Fatigue Loading Sequence
Fatigue - Endurance Data	FSTAFFmd	1.0	Modified FALSTAFF Standard Fatigue Loading Sequence

Series	VIEWpac	VIEWpac Version	VIEWpac Title
Fatigue - Endurance Data	TWIST	1.0	TWIST Standard Fatigue Loading Sequence
Fatigue - Endurance Data	W9724	1.0	Derivation of endurance curves from fatigue test data, including run-outs
Heat Transfer	ENTRAN	1.0	Heat transfer enhancement in heat exchanger design and utilisation. Part 1. Tube inserts in single-phase flow
Mechanisms	AMOPS	1.3	Computer program for the calculation of the area and moments of area of planar shapes
Mechanisms	OSCAM	5.3	OSCAM for Windows - Computer-aided cam design
Mechanisms	OSMEC	7.2	OSMEC. Computer-aided linkage design
Mechanisms	W0605	3.0	Kinematic analysis of disc cams
Mechanisms	W9126	4.0	Analysis of cam roller followers
Mechanisms	W9301	4.0	Contact stress in disc cams with roller followers
Mechanisms	W9408	3.0	Lubricant film thickness between cams and followers
Mechanisms	W9411	3.0	Contact stress in disc cams with domed or flat-faced followers
Stress and Strength	AMOPS	1.3	Computer program for the calculation of the area and moments of area of planar shapes
Stress and Strength	ESDU 15005 Tables	1.0	ESDU 15005, Stress concentration factors for optimised holes in flat plate
Stress and Strength	ESDU 15006 Tables	1.0	ESDU 15006, Stress concentration factors for optimised notches and fillets in flat plate
Stress and Strength	W9724	1.0	Derivation of endurance curves from fatigue test data, including run-outs
Structures	AMOPS	1.3	Computer program for the calculation of the area and moments of area of planar shapes
Transonic Aerodynamics	e1809	1.0	Turbulent boundary layer profile generator
Transonic Aerodynamics	ecrit1	1.0	Calculation of Roughness Particle Height in Transition Strips (Flat Plate)
Transonic Aerodynamics	ecrit2	1.1	Calculation of Roughness Particle Height in Transition Strips (Flat Plate)
Transonic Aerodynamics	ecrit2	1.1	Calculation of Roughness Particle Height in Transition Strips (Flat Plate)
Transonic Aerodynamics	FP	2.0	Full-potential method for three-dimensional wings and wing-body combinations - inviscid flow
Transonic Aerodynamics	FP	2.0	Full-potential method for three-dimensional wings and wing-body combinations - inviscid flow
Transonic Aerodynamics	FP	2.0	Full-potential method for three-dimensional wings and wing-body combinations - inviscid flow
Transonic Aerodynamics	FP	2.0	Full-potential method for three-dimensional wings and wing-body combinations - inviscid flow
Transonic Aerodynamics	FPFBL	1.0	Matlab: A program to calculate the displacement thickness over a wing

Series	VIEWpac	VIEWpac Version	VIEWpac Title
Transonic Aerodynamics	SURFIN	1.0	Method to determine surface finish required to minimise local skin friction in the presence of a turbulent boundary layer
Transonic Aerodynamics	vfpanalysis	9.0	VFP Analysis Program
Transonic Aerodynamics	VFPH	1.0	VFP viscous full-potential wing/body method
Transonic Aerodynamics	W0315	1.0	VGK for Windows
Vibration and Acoustic Fatigue	M1012	1.0	Matlab: Application of Linear Regression Analysis to Acoustic Fatigue Data
Vibration and Acoustic Fatigue	M1105	1.0	Matlab: Propeller noise in non-axial inflow
Vibration and Acoustic Fatigue	M1108A	1.0	Matlab: Modal Density of Sandwich panels

About Accuris

Accuris is an engineering data and technology company that delivers holistic workflow solutions to empower engineering and technical professionals to identify, design, build, and accelerate innovation in market. We also work closely with our Standards Development Organization partners to support their non-profit mission of advancing global knowledge across engineering disciplines. Our solutions combine 60+ years of trusted technical data with proprietary technology to increase efficiency and reduce risk

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