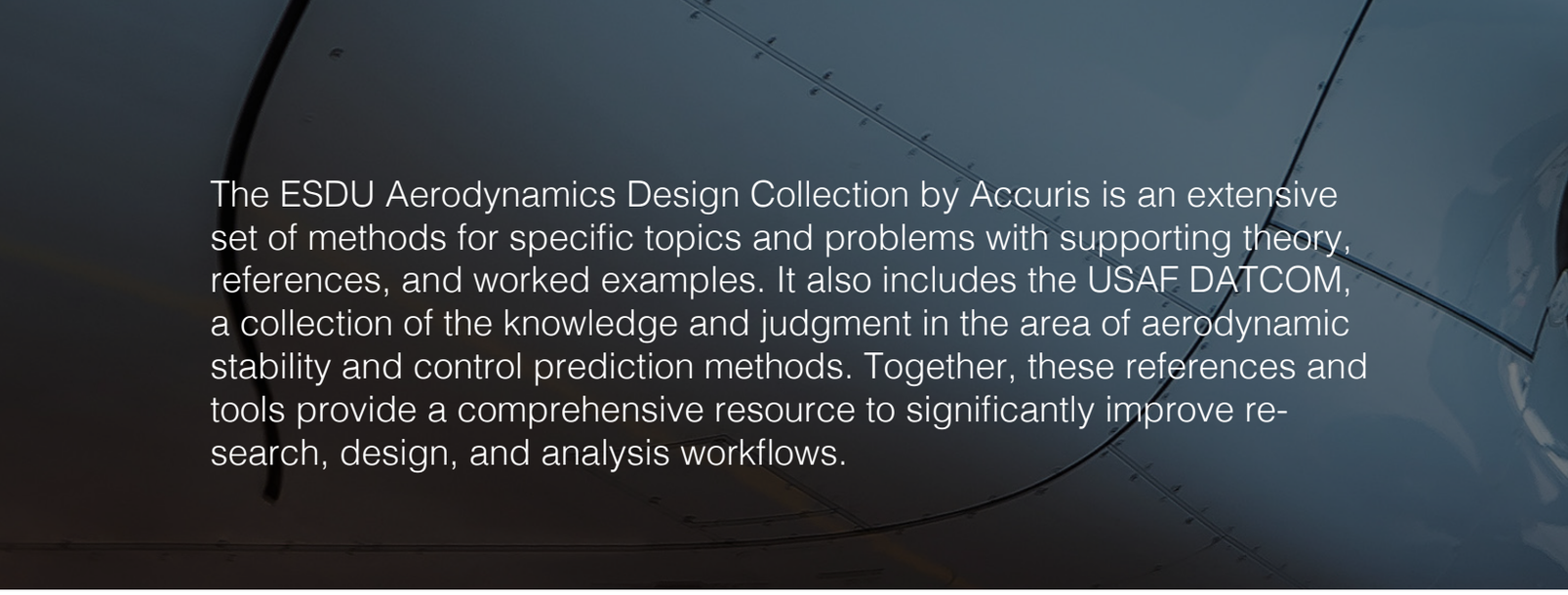
ACCURIS

ESDU Aerodynamics Design Collection

Advanced Methods, Data and Software for Aerostructure Design and Analysis



The ESDU Aerodynamics Design Collection by Accuris is an extensive set of methods for specific topics and problems with supporting theory, references, and worked examples. It also includes the USAF DATCOM, a collection of the knowledge and judgment in the area of aerodynamic stability and control prediction methods. Together, these references and tools provide a comprehensive resource to significantly improve research, design, and analysis workflows.

ESDU VALIDATED DATA AND METHODS

ESDU offers a unique collection of validated design guides and methods that are co-developed by aerospace industry expert committees and ESDU engineers. This collaboration allows the aerospace industry worldwide to identify knowledge gaps and share best practices and data to develop consensual solutions that can be applied with confidence.

ESDU design tools enable users to minimize the time required to run complex calculations with:

- Fully developed prediction methods calibrated against qualified data from multiple sources
- Detailed descriptions of the principles on which methods are based
- Best analysis methods described with ranges of accuracy, references, derivation lists, and worked examples
- Stated limits of the method's applicability with guidance for interpreting results in a practical engineering context
- Detailed calculation diagrams to show program data flows and
- The ability to capture conditions and reuseprevious calculations. The ESDU Aerodynamics Design Collection helps you move through the initial design phase with validated engineering methods, data, principles and worked examples for the following topics.

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GENERAL

- Properties of gases: air and other gases to high temperature
- Isentropic flow and shock waves: simple wave flow, plane, oblique, conical shock waves, pitot-static tubes
- Properties of the atmosphere: standard and design, true / equivalent airspeed
- Reynolds number / kinetic and total pressures
- Wind speeds and atmospheric turbulence: mean hourly and gust speeds, turbulence characteristics

GENERAL

- General: geometry of cranked or straight-tapered wings
- Airfoils at subcritical speeds: pressure distribution, lift, pitching moment, aerodynamic center, separation
- Airfoils at supersonic speeds: pressure distribution, lift, pitching moment, drag
- Critical Mach number and pressure coefficient
- Flat plates: boundary layers, skin friction, effect of surface roughness
- Wings: lift, pitching moment, aerodynamic center, angle of attack at zero lift, separation boundaries
- Wings: spanwise loading, pitching moment, maximum lift, cropped delta normal force / pitching moment
- Wings: drag (lift-dependent, wave drag, drag rise)

BODIES

- General: geometry, velocity distribution, boundary layers
- Drag: profile, wave, base and boat-tail (subsonic / supersonic), rear fuselage upsweep, forebody pressure (supersonic / hypersonic)
- Base drag: at angle of attack, effect of stabilizing fins, jet effects
- Pressure distribution, normal force, pitching moment, center of pressure

WING-BODY COMBINATIONS

- Lift, normal force, pitching moment, aerodynamic
- center, upwash
- Drag – area rule, drag rise

CONTROLS AND FLAPS

- Controls: lift / pitching moment effectiveness, spoiler drag, lift and rolling moment, rudder / aileron derivatives
- Controls: hinge moment, effect of tab / balance
- Flaps: airfoil leading- and trailing-edge devices, lift increment, maximum lift, normal force
- Flaps: wing leading- and trailing-edge devices, lift increment, maximum lift, part-span effects
- Flaps: wing trailing-edge devices, lift curve to maximum lift, pitching moment increment, drag increment, partspan effects

EXCRESCENCES

- Excrescence drag: cavities, grooves, steps, ridges, rivets, cylinders, stub wings, fairings
- Excrescence drag magnification by pressure gradient, control gap drag, excrescence drag calculation example
- Landing gear drag: fixed or retractable
- Canopy drag: fighter-type

CAVITY AERODYNAMICS

- Cavity drag
- Unsteady cavity flow
- Suppression devices

INTERNAL FLOW SYSTEMS

- Ducts: one dimensional
- Nacelles, intakes and nozzles: jet flow field, intake and jet flow parameters, supersonic rectangular intakes, drag and pressure recover

POWERPLANT / AIRFRAME INTERACTIONS

- Propeller-powered aircraft: thrust / drag accounting, propeller / body interaction, propeller / nacelle / wing / flap interaction, inclined propeller forces
- Jet powered aircraft: jet / flap interaction

STABILITY OF AIRCRAFT

- General: derivatives, equations of motion, axes conversion
- Longitudinal stability: ground effect, downwash, tandem lifting surfaces, tailplanes (including twin fins)
- Pitching derivatives: aircraft / subsonic, wings and projectiles / supersonic
- Subsonic sideslip derivatives due to wing / body, flaps, fins, complete aircraft
- Supersonic sideslip derivatives due to fin / tail, ventral fins, supersonic lift and center of pressure of lifting surface
- Subsonic derivatives due to rolling for wing, fin, complete aircraft and supersonic roll damping for wing / body
- Subsonic derivatives due to yawing for body, wing, flaps, fin, complete aircraft

UNSTEADY AERODYNAMICS

- Unsteady aerodynamics: basic principles, subsonic / supersonic air force coefficients and load distribution on wings / bodies, aircraft response, gusts, buffeting, windtunnel resonance

BLUFF BODIES AND STRUCTURES

- Mean forces: basic principles, single circular, rectangular, or multi-sided cylinder
- Fluctuating forces and response: along-wind buffeting, cylinder due to vortex shedding, cylinder groups

AERODYNAMIC HEATING & HEAT TRANSFER

- Aerodynamic heating and heat transfer: forced convection to plate, wedge, cylinder, duct, kinetic heating and equilibrium temperature

AERODYNAMIC HEATING & HEAT TRANSFER

- Wind-tunnel corrections: lift and blockage in subsonic ventilated, bluff body blockage in confined flows

USAF DATCOM

The USAF Stability and Control DATCOM (Data Compendium) provides a summary of methods for estimating basic stability and control derivatives Intended to be used for preliminary design purposes before the acquisition of test data, it includes methods ranging from very simple and easily applied techniques to very accurate and thorough procedures. Tables which compare calculated results with test data provide indications of method accuracy and references to related material are also included.

USAF DATCOM

DATCOM is divided into nine major sections based on the type of stability and control parameter.

Volume 1

- Guide to DATCOM and Methods
- General Information
- Effects of External Stores

Volume 2

- Characteristics at Angle of Attack

Volume 3

- Characteristics in Sideslip
- Characteristics of High-Lift and Control Devices

Volume 4

- Dynamic Derivatives
- Mass and Inertia
- Characteristics of VTOL-STOL Aircraft

DATCOM methods have not been validated by ESDU but contribute to a comprehensive collection of aerodynamics design information and can be used along side ESDU methods for comparison and analysis to solve design problems.

About Accuris

Accuris is an engineering-focused technology company that delivers value through AI-powered data and workflow solutions. For over 60 years, engineers have relied on our data and technology to innovate and solve problems, reducing their ideation time by 70% and eliminating product and process failures by up to 5 times.

We work with over 7,000 global customers and 950,000 engineering end users in over 100 countries and dozens of industries – including aerospace and defense, energy, sustainability, construction, architecture and more.

Accuris partners with 450+ Standards Development Organizations to help streamle your access to 2.3 million engineering standards to accelerate innovation and progress across the globe. Accuris unleashes builders so you can build a better world.

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