IHS PRODUCT DESIGN

IHS ESDU – Access 70 Years of Aircraft Design History

ESDU for Academia

A selection of ESDU Series provides data and software tools to cover course programs that include:

- **Aerodynamics –** a wide range of data and methods applicable to aircraft design, atmospheric properties; aerodynamics of controls, flaps and leading-edge devices; aircraft stability, aerodynamics of internal flow systems, and more.
- **Aircraft Noise –** reliable methods for the prediction of sound levels generated by various sources, and an understanding of the control and suppression of noise.
- **Aerospace Structures –** Data are given 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.

Supporting the next generation of industry experts

ESDU has a database of over 1,500 engineering design topics, and the use of its design methodologies within Academia has become an important building block for students and faculty over the years. In this ever demanding area, ESDU will prepare your students with the right tools that are being used within aircraft/aerospace oriented research, development, and design industries.

The resources that your institution provides can continue to play a critical role in developing the skills that will enable your students to succeed.

And, there is no doubt that your institution's library activity strives to maintain the reference material to ensure that these students and researchers are basing their work on current knowledge and practices.

What are the benefits to you?

- Once your student's graduate, those that are already using ESDU have a greater opportunity to be well placed within the industry.
- ESDU is widely used by international aerospace companies and other engineering industries. It is considered to be the most accurate, up-to-date and comprehensive collection of **validated** aerospace data and methods available. For example many Boeing and Airbus airplanes have employed numerous **ESDU Best Practice Design Guides** and incorporated them within their designs.
- Each series is produced and validated by committees of **experts** drawn from a broad range of academic, research, and industry backgrounds. Information is presented in a **clear and concise format**, and is the result of careful distillation from a wide range of information sources. In addition, there is a strong emphasis on the use of unpublished information taken from sources only available to ESDU – a direct result of key communication links with academic and industrial institutions and companies.
- The **Committee Structure** developing and vetting ESDU designs and methodologies consists of over **250 members**.

ESDU for Academia (continued)

- **Performance –** The information on performance estimation can be used for design and development, project and research studies, pre-flight specification and, finally, the synthesis of precise operational data based on flight test results.
- **Stress and Strength –** applicable and relevant to the metals used in engineering and to any other isotropic material such as glass, rubber, or plastic.
- **Transonic Aerodynamics –** series is concerned with the flow around aerofoils, wings, bodies and cowls at high subsonic, transonic and (in a few cases) low supersonic speeds.
- **Vibration & Acoustic Fatigue –** used to design reliable structures for use in areas which is excited by noise; provides methods for estimating the response and fatigue life of structures when subjected to acoustic loading.

Faculty of Engineering Departments

ESDU data can also be applied by faculty heads within their teaching methods and incorporated into the curriculum. The unique advantage of this source of material is to broaden student knowledge and awareness of system design aspects that encompass materials, fluid flows, pressure, fatigue and vibration, to name just a few. It encourages them to think laterally and emulate practical every day engineering tasks.

Aerospace/Aeronautical Engineering
Aerodynamics, Performance, Fluid-Flow, Dynamics and Control, Propulsion, Fatigue and Fracture Analysis, Vibration and Acoustics.

Mechanical Engineering
Fluid dynamics, Mechanisms, Tribology, Statistics, Thermodynamics, Vibration, Fatigue, Structures and Materials.

Manufacturing Engineering/Metallurgy
Mechanical Properties, Microstructure, Structures, and Bonding Deformation of Materials, Composites and Material Selection

Civil/Structural Engineering
Structural Engineering and Fluid Mechanics.

ESDU Academic Package

The ESDU Academic package provides data and software tools that address the full range of design methods and includes:-

- Aerodynamics
- Aircraft Noise
- Composites
- Dynamics
- Fatigue – Endurance Data
- Fatigue – Fracture Mechanics
- Fluid Mechanics, Internal Flow
- Heat Transfer
- Mechanisms
- Performance
- Physical Data, Chemical Engineering
- Stress and Strength
- Aircraft Structures
- Transonic Aerodynamics
- Tribology
- Vibration and Acoustic Fatigue
- Wind Engineering
- MMDH (Metallic Materials Data Handbook)

Pressure Vessel Design Project

Here is a short example of an undergraduate project/thesis students can undertake using ESDU to design a pressure vessel containing a specified volume of fluid without leakage for a specified life.

> Designing a pressure vessel to store ___m^3 of oil maintained at a nominally constant operating pressure and temperature of ___N/m^2 and ___°C, respectively. The operating life of the system is___years and the pressure vessel is filled and emptied ___times a day.

To develop the design, use ESDU Data Items in the Structures, Fatigue Endurance Data, Fluid Mechanics Internal Flow, and Stress and Strength Series. The MMDH series may also be consulted for material properties.

Preliminary Design

Data Items 65002, 66010 and 67017 provide guidance for determining the elastic stresses in cylinders and pressure vessels of various shapes.

Pipe Design

Develop the pressure vessel design to include the inlet and outlet pipes. These pipes must be connected to other parts of the pressurised system by bolted joints to facilitate installation and replacement. Consider ESDU Data Items 74043, 75014 and 81041 to analyse the pipe stresses and Data Items 85021, 86014 and 87023 for the bolted joint. Data Item 64001 is the starting point for assessing the effect of any stress concentrations that may occur in the design.

Assessing the possibility of Fatigue Failure

Consult the ESDU Fatigue Endurance Data and analyses capable of assessing the potential for fatigue failure of the pressure vessel, its associated piping and bolted joints

Design Development

A modal analysis can be carried out using the same FEA model to estimate the fundamental natural frequency of the vessel. Refer to ESDU Data Items within the Fluid Mechanics, Internal Flow series for guidance on the significance, or otherwise, of pressure surges in the system.

To discover more about ESDU and all of the Series, packages, handbooks and data items available, visit www.ihsesdu.com.

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