

Fundamentals of Aeronautical Engineering

Grundlagen des Flugzeugbaus

Introduction

The course covers the fundamentals of the main disciplines of aeronautical engineering and their interdependencies. The disciplines covered are: Aerodynamics, flight mechanics, propulsion, aircraft systems, aircraft structures and aircraft design.

Goal

Participants shall obtain the capability to understand their specialized work task in the frame of the aviation system. They should see their work as part of the development cycle of an aircraft and should be able to relate their work to aeronautical fundamentals.

Course Structure

THE AVIATION SYSTEM --- **Das Luftverkehrssystem**

- Aviation politics
- Air traffic control (ATC)
- Airlines
- Airports
- Manufacturers and subcontractors

AERODYNAMICS --- **Aerodynamik**

- Some basic definitions
- Airfoils
- Separation of flow
- Global loads on aircraft
- Lift
- Drag
- Stall
- Sonic waves
- Transonic regime
- Breaking the sound barrier
- Supersonic regime
- Supercritical wings
- Swept wing
- Wingtips / Winglets
- Flight in Ground Effect
- Propeller

FLIGHT MECHANICS --- Flugmechanik

Aircraft translation
Aircraft polar
Aircraft rotations
Flight controls
Basic flight evolutions
Critical flight regimes: the spin
Aerobatic flight
Aircraft stability (some notions)
The canard solution

AIRCRAFT SYSTEMS --- Flugzeugsysteme

Aircraft Systems – General

Aircraft Systems – The Airbus A321

Air Conditioning (ATA 21)
Auto Flight (ATA 22)
Communication (ATA 23)
Electrical Power (ATA 24)
Equipment / Furnishings (ATA 25)
Fire Protection (ATA 26)
Flight Controls (ATA 27)
Fuel (ATA 28)
Hydraulic Power (ATA 29)
Ice & Rain Protection (ATA 30)
Indicating & Recording (ATA 31)
Landing Gear (ATA 32)
Lights (ATA 33)
Navigation (ATA 34)
Oxygen (ATA 35)
Pneumatic (ATA 36)
Water/Waste (ATA 38)
Auxiliary Power (ATA 49)

AIRCRAFT ENGINES --- Flugzeugtriebwerke

1. Basics
 - Propulsion
 - Thrust
 - Combustion
2. General classification of aircraft engines
3. Some history
4. Piston engines

5. Jet engines

5.1 Thermojets

- Turbojets
- Components of a jet engine
- Inlets
- Compressor
- Turbine
- Burner
- Nozzle
- Afterburning jet thrust
- Thrust reversing

5.2 Turbofans

5.3 Propfans

5.4 Ramjets

5.5 Scramjets

AIRCRAFT STRUCTURES --- Flugzeugstrukturen

1. Materials and their properties

- Strain-stress-curve
- Typical design data for materials
- Wood and canvas
- Iron and steel
- Aluminum
- Composite materials
- Typical design

2. Structure of a conventional aircraft

- General principles
- Wing
- Other aerodynamic surfaces
- Fuselages
- Landing gear
- Fabrication of structural components
- Completion
- Composite technologies
- Sandwich technologies

3. Airworthiness and airframe loads

- General principles
- Weight and load
- Flight envelope
- Cabin pressure
- Fatigue
- Safe life and fail-safe structures

AIRCRAFT DESIGN --- Flugzeugentwurf

Part 1: Multi media presentation - From requirements to the 3-view-drawing

Part 2: Lecture

1. Introduction
2. Design Sequence
3. Preliminary sizing
 - Introduction
 - Landing distance
 - Take-off distance
 2. segment climb rate
 - L/D estimation with landing gear and flaps
 - Missed approach climb rate
 - Cruise
 - Thrust-to-weight ratio
 - Wing loading
 - Maximum L/D estimation in cruise
 - Sizing diagram
 - Maximum take-off mass
 - Useful load
 - Fuel fractions
 - Take-off thrust and wing surface
4. Literature

PreSTo-Classic: EXCEL-Sheet for Preliminary Sizing of Passenger Aircraft
(Berechnungsschema zur Flugzeug-Dimensionierung)
<http://fe.ProfScholz.de>

"WÖRTERBUCH" zum Unterricht

Zum leichteren Verständnis der englischen Unterlagen wird den Teilnehmern ein kleines Luftfahrtwörterbuch an die Hand gegeben, das speziell die Fach-Vokabeln enthält, die im Unterricht genutzt werden.

Point of Contact

Prof. Dr.-Ing. Dieter Scholz, MSME
<http://www.ProfScholz.de>
E-Mail: info@ProfScholz.de
Tel.: +49-40-18119881

Update: 2018-12-15
Download: <http://AeroFundamentals.ProfScholz.de>
Published: Aircraft Design and Systems Group (AERO)
CC-License: CC BY-NC-SA

