Universidad
Carlos III de Madrid
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Aerospace Structures

Authors: Enrique Barbero Pozuelo, José Fernández Sáez, Carlos Santiuste Romero

Introduction

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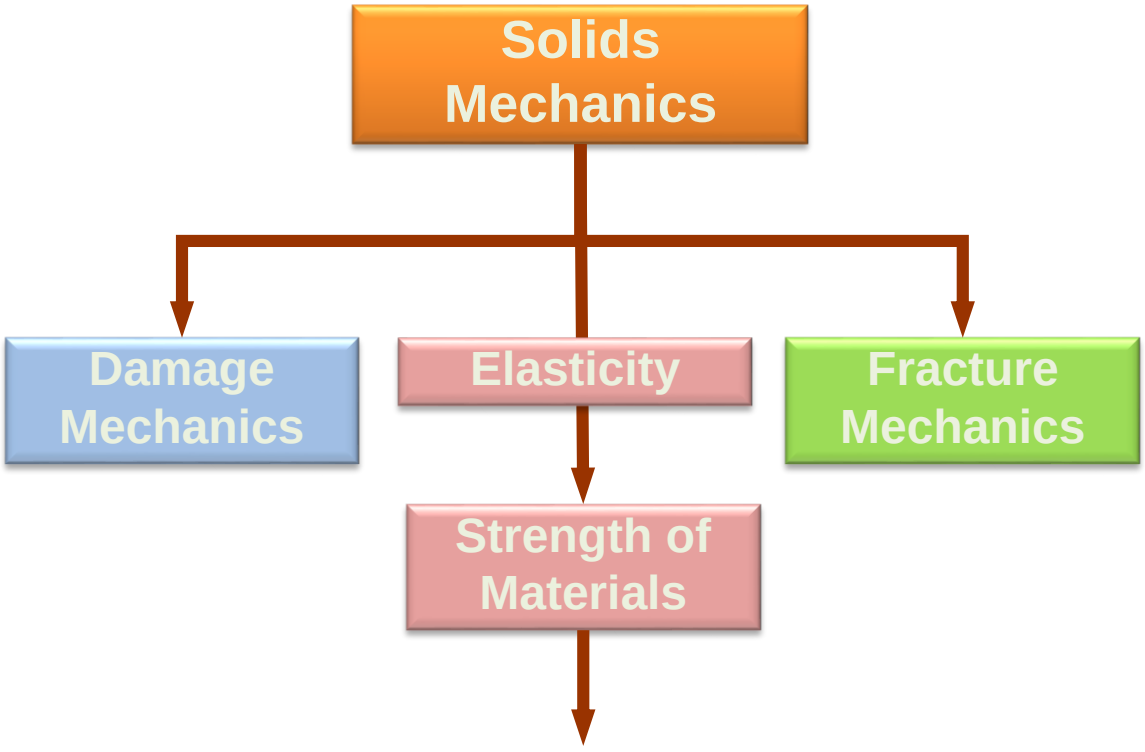
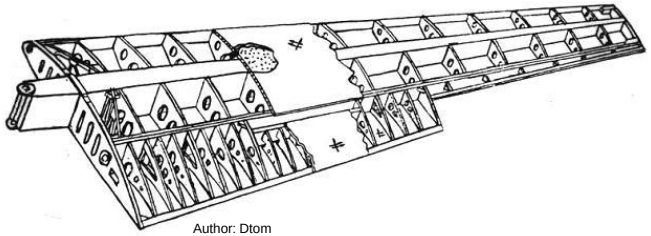
Introduction





Author: Dtom
http://commons.wikimedia.org/wiki/File:Wing_with_one_spar.JPG?uselang=es

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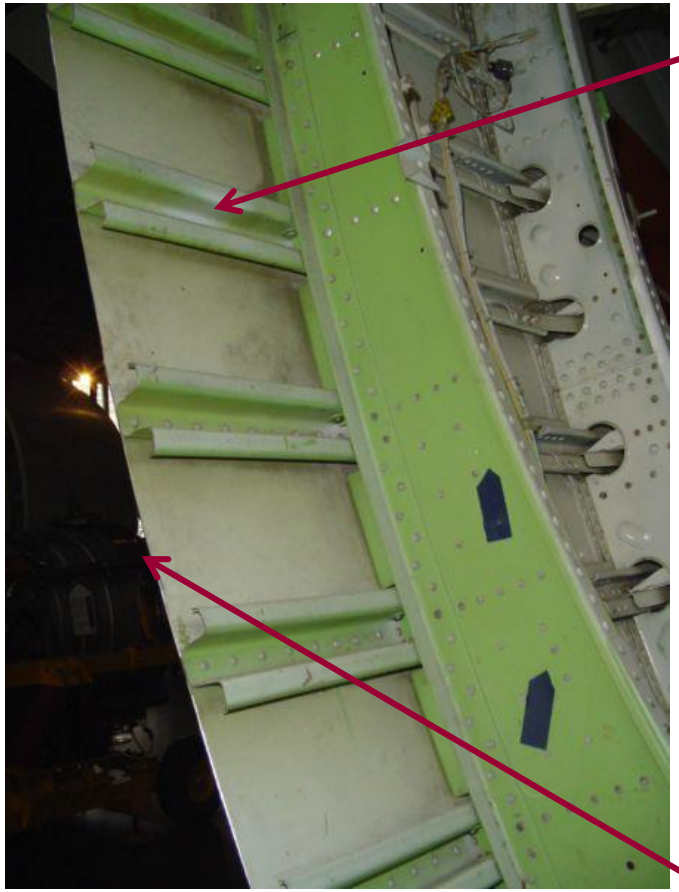
Author: Kolossos
http://commons.wikimedia.org/wiki/File:Fuselage-747.jpg?uselang=es

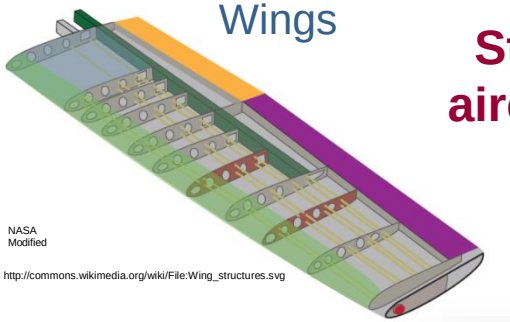


Fuselage of a Boeing 747

Thin-walled beams

Thin plates

Wings



NASA
Modified

http://commons.wikimedia.org/wiki/File:Wing_structures.svg

Stress analysis of aircraft components

Fuselage

Bibi95
http://commons.wikimedia.org/wiki/File:Exposition_-_Les_100_ans_de_l%27a%C3%A9rospatiale_-_Paris_-_4_Octobre_2008_(2913799759).jpg

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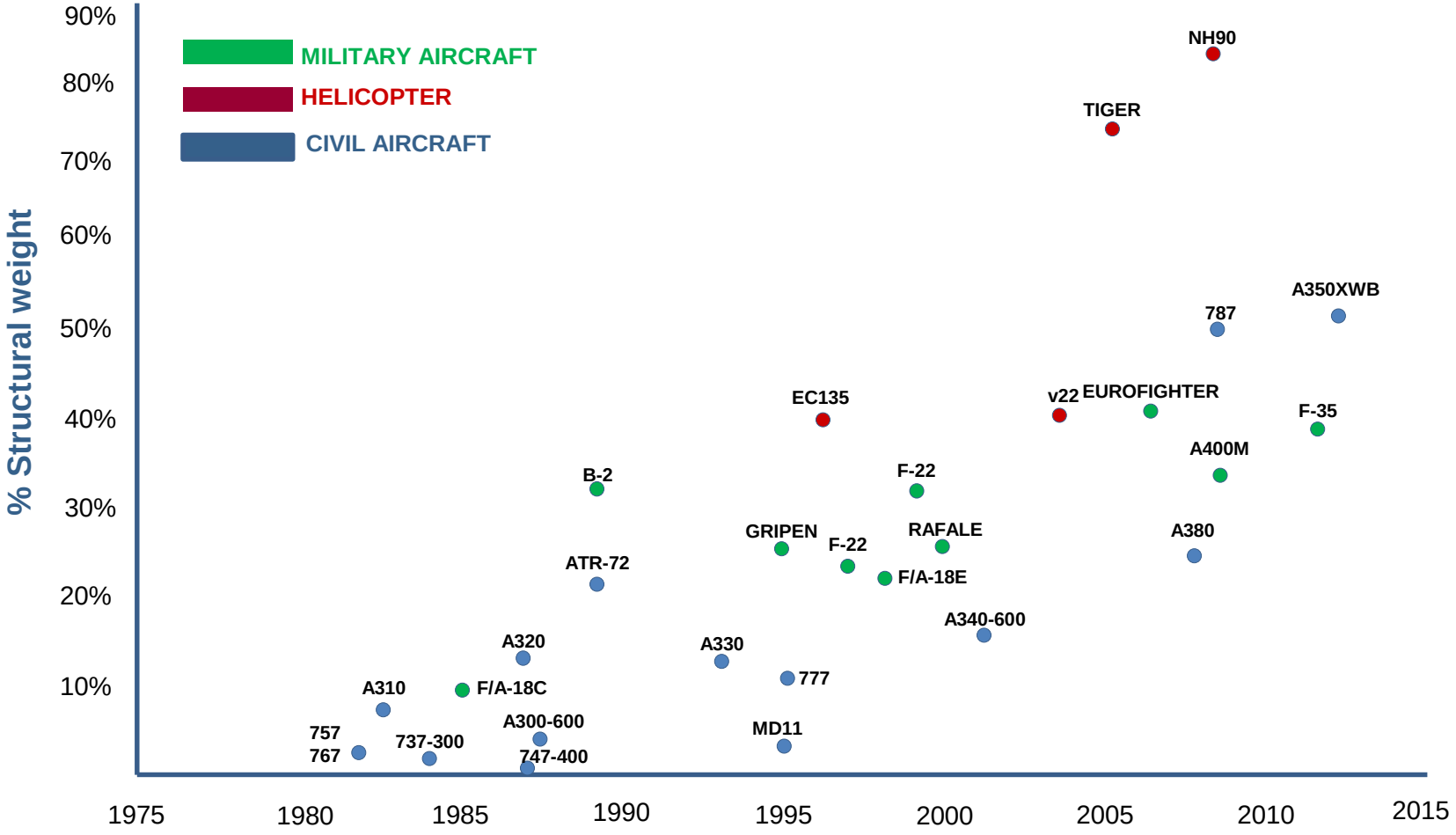
Composite Structures



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Hypotheses

Solid Mechanics

- Deformable body
- Newton's Mechanics applicable
- Thermodynamics laws applicable

Elasticity

- **Linear elastic behaviour:** The Hooke's law is assumed the constitutive equation of the material.
- **Homogeneous and isotropic material:** identical mechanical properties in every material point and identical mechanical properties in every material direction.
- **Quasi-static loads:** Loads acting on the structural element slowly applied, in such a way that the inertial effects can be neglected.
- **Saint-Venant´s principle:** the value of the internal forces in material points located far enough from the zone corresponding to the loads application is independent of the force system distribution (if they are mechanically equivalent).

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Previous knowledge

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Previous knowledge

Matrix Algebra

Vector calculus

Mechanic

- Resultant forces
- Center of mass
- Moment of inertia
- Equilibrium of rigid bodies
- Algebraic and differential operations with vectors and scalars

...

Elasticity

Strength of Materials

- Concept of stress and strain
- Constitutive equations
- Calculus of internal forces
- Stresses in cross-sections
- Displacement in beams...

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Objetives and skills

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Objetives and skills

- Knowledge of the basic tools for the calculation of thin-walled beams, that provide to the student the ability to design structural components of the aerospace industry.
- Acquisition of the technological knowledge needed to calculate bidimensional structural elements used in aerospace structures.
- Knowledge of the basics of the design of structures made of composite materials, including composite laminates and sandwich structures, which are widely used in aerospace industry.
- Ability to use specific software to analyse, design and calculation of structural elements, developing a critical awareness.

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Description of contents

PROGRAMME

Chapter 1. Description of aeronautical structures

1.1 Aircraft load

1.2 Structural component of the aircraft

1.3 Structures in the aeronautical sector

Chapter 2. Bending, shear and torsion of thin-walled beams

2.1 Bending and shear of open and closed, thin-walled beams

2.2. Torsion on single-cell thin-walled beams

2.3. Torsion on multiple-cell thin-walled beams

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PROGRAMME

Chapter 3. Thin plate theory

- 3.1. Bending of thin plates (I)
- 3.2 Bending of thin plates (II)
- 3.2. Shell

Chapter 4. Composite and sandwich structures

- 4.1. Laminate theory
- 4.2. Composite beams
- 4.3. Sandwich structures

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Department of Continuum Mechanics and Structural Engineering

http://www.uc3m.es/mmcyte

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