



Arts et Métiers ParisTech, Site de Talence

Mechanics of composite materials and structures for aerospace applications (6 ECTS)

Professor(s): Dr. F.Dau, Dr. M.Montemurro, Dr. T. Palin-Luc

Locations of the courses: Arts et Métiers ParisTech Talence

Language: English

Distribution of courses: Lectures: 17.5h, Lab: 20h + 17.5h (Lectures and Applications)

Description:

FIRST PART

• **Aeronautical materials and processes to obtain structural parts (Lectures: 17.5h)**

1. Materials in aircraft structural parts, criteria for material selection, technical specification of materials (composition and properties).
2. Composite materials for aeronautical applications: generalities, manufacturing processes, features and properties of composite materials, classification of composite materials, composites life cycle.

• **Analysis and design of aeronautical structures (20 h, Lab)**

3. Generalities about lightweight structures
4. Mechanics of thin-walled structures : theory and applications
5. Theories and models for plates and shells
6. Structural stability: buckling behavior and post buckling behavior
7. numerical applications

SECOND PART

1. **Fatigue and damage tolerance in aeronautic materials and structures (17,5 h - lectures and applications)**

- Calculation methods against crack initiation under multiaxial loadings

Examples of in service fatigue failures, Physical phenomena responsible for fatigue crack initiation in metals; low cycle fatigue and high cycle fatigue; criteria for designing components against crack initiation under multiaxial stress states; factors influencing fatigue crack initiation on metals (roughness, residual stresses, defects, environment, size effect, notches) and how to take them into account in simulation. Applications.

- Fracture mechanics and damage tolerance concept

Base of Linear Elastic Fracture mechanics, concept of stress intensity factor, Paris law, effect of the loading ratio on the crack growth rate, threshold of crack propagation, calculation of inspection period and intervals of inspections; proof test; usage in damage tolerance approach of non-destructive testing techniques for crack monitoring.

Applications.

Evaluation

First session

FIRST PART (Aeronautical materials and processes to obtain structural parts)

1. 2 written tests of 1h (coef. 0.25 each)
2. Report on numerical activities (15p.) (coef. 0.25)

SECOND PART (Fatigue and damage tolerance in aeronautic materials and structures)

Final Assignment (2h) (coef. 0.25)

Second session

Same as 1st session. Nevertheless, students have to pass only for grades < 10. The best grades will be kept between session 1 and session 2 for the grading of the whole module.