Modeling of advanced composites: processing and mechanical properties

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Cursus     Sem.     Type
Manufacturing Obl.
Science et génie des matériaux Obl.

Language  English
Credits  1
Session  Multiple
Exam  
Workload  30h
Hours  14
Lecture  14
Number of positions  20

Frequency
Every 2 years

Summary
This course introduces the main phenomena in composite processing and mechanical as well as hygrothermal properties and the methods to model them, mostly analytically. Teaching is ex-cathedra with a term paper on a topic defined with the teachers.

Content
1. Brief introduction on composites and their processing techniques
2. Composite processing: governing phenomena
3. Multi-phase flow, saturation and capillary phenomena
4. Mechanics of fiber reinforcement, introduction into process models
5. Effective property analysis
6. Stress transfer in short fiber composites
7. Fracture and damage models
8. Interfacial mechanics, residual stresses

Keywords
Modeling, composite processing techniques, flow in porous media, composite mechanics, damage models, process-induced stresses.

Learning Prerequisites
Recommended courses
Prerequisites for the course include the knowledge of kinetics and transport phenomena, and of polymers, as relevant to materials science and engineering. Prior knowledge of basic composites (classical laminate theory, basic micromechanics) is recommended, upon request, some notes or references can be transmitted to the students.

Learning Outcomes
By the end of the course, the student must be able to:

• Propose modelling methods for a given composite process or property
• Analyze critically the literature on composite modelling

Transversal skills
• Write a literature review which assesses the state of the art.
• Access and evaluate appropriate sources of information.

Teaching methods
Ex-cathedra

Assessment methods
• Term paper
• Oral presentation

Resources
Bibliography
Liquid composite moulding, R. Parnas, Hanser Gardner, June 2000
Fiber-reinforced composites P.K. Mallick, Marcel Dekker, Inc, 1993

Ressources en bibliothèque
• Fiber-reinforced composites / Mallick
• Engineering mechanics of composites materials / Daniel
• Comprehensive composite materials / Kelly
• Process modeling in Composites manufacturing / Advani
• Composite reinforcements for optimum performance / Boisse
• Matériaux composites / Gay
• Liquid composite moulding / Parnas