UCL Faculté des sciences appliquées

FSA

MECA2141 Rhéologie

[30h+30h exercises] 5 credits

This course is taught in the 1st semester

Teacher(s): Roland Keunings
Language: french
Level: 2nd cycle course

Aims

Introduce the student to the multidisciplinary topics of rheology and non-Newtonian fluid mechanics: phenomenology of rheologically-complex fluids, mathematical modelling based on continuum mechanics and molecular kinetic theory, analytical solution of simple problems, approaches to computer simulation of industrial flows, introduction to current research in the field.

Main themes

Phenomenology of rheologically-complex flow behaviour.
Mathematical modelling based on continuum mechanics.
Mathematical modelling based on molecular kinetic theory.
Analytical solution of simple flow problems.
Computer simulation methods for complex industrial flows.
Introduction to modern research topics in the field.

Content and teaching methods

Phenomenology of rheologically-complex flow behaviour: observed experimental linear and non-linear viscoelastic behaviour in shear and elongational flows.
Mathematical modelling based on continuum mechanics: conservation laws and a hierarchy of constitutive rheological equations (generalized Newtonian fluid, linear viscoelastic models, differential and integral models).
Mathematical modelling based on molecular kinetic theory: how to obtain constitutive equations from molecular models of statistical mechanics, detailed consideration of dilute and concentrated polymer solutions ("Rouse" and "tube" models).
Simple flow problems: analytical solutions using the macroscopic and "molecular"constitutive equations listed above, comparison with experimental data and critical evaluation.
Complex industrial flows: discussion of the basic macroscopic and micro-macro approaches to computer simulation in non-Newtonian fluid mechanics, illustration of modern techniques and recent results.
Introduction to research topics in the field: illustration of current themes based on the lecturer's research activities.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

- Prerequisites: Mechanics of continuum media (FSA2901).
- Exam: oral and open book (50% of final mark); individual work during semester (e.g. to read, report, and present orally a scientific paper) counts for the other 50%.

Other credits in programs

INCH23	Troisième année du programme conduisant au grade d'ingénieur civil chimiste	(5 credits)
MAP22	Deuxième année du programme conduisant au grade d'ingénieur civil en mathématiques appliquées	(5 credits)
MAP23	Troisième année du programme conduisant au grade d'ingénieur civil en mathématiques appliquées	(5 credits)
MECA22	Deuxième année du programme conduisant au grade d'ingénieur civil mécanicien	(5 credits)
MECA23	Troisième année du programme conduisant au grade d'ingénieur civil mécanicien	(5 credits)