UE Fluid Mechanics and Granular Materials

Niveau d'étude
Bac +5

ECTS
6 crédits

Crédits ECTS Echange
6.0

Composante
UFR Informatique, mathématiques et mathématiques appliquées (IM2AG)

Période de l'année
Automne (sept. à dec./janv.)

Diplômes intégrant cet élément

- Master Mathématiques et applications

Langue(s) d'enseignement: Anglais
Ouvert aux étudiants en échange: Oui
Crédits ECTS Echange: 6.0
Code d'export Apogée: GBX9AM43

Présentation

Description

The first part of the lecture introduce to mathematical modeling of fluid mechanics and the numerical resolution of the associated equations. Equations are classified by three main families of models:

1. environmental problems: yield stress fluids (Bingham type) for granular matter, e.g. snow avalanches, mud or ice flows, erosion, landslides and volcanic lavas.
2. industrial problems: viscoelastic fluids (Oldroyd type) for plastic material processes, and metallic alloy.
3. biological problems: elastoviscoplastic fluids, for blood flows, liquid foam flows, and for food processing (mayonnaise, ketchup, etc).

Equations and models are presented in a continuum setting, and then approximated in time and space. Then, the efficient numerical resolution is addressed with some examples of practical applications.

Informations non contractuelles.
Dernière mise à jour le 30 juin 2026

The second part of the lecture propose a deeper analysis of granular models. The mathematical study of these complex matter is an important numerical and physical challenge. We will show how it requires a general view related to nonlinear PDEs. The objective of this course will be two-fold:

- Show how the compressibility and the viscoplasticity of the phenomenon can play an important role
- Discuss congestion phenomena in granular media (maximum packing) that can be compared mathematically to floating structure phenomena in the presence of a free boundary.

Students who complete the course will have demonstrated the ability to do the following:

- formulate and solve a large number of nonlinear physical and mechanical problems.
- demonstrate a familiarity with fluid mechanics and complex materials
- synthesize and implement efficient algorithms for various applications of industrial type.

The main idea of this lecture is to motivate by examples interdisciplinary collaborations needed to deal with complex situations.

Heures d'enseignement

CM	CM	36h

Pré-requis recommandés

Applied mathematics and scientific computation.

Période : Semestre 9

Infos pratiques

Contacts

Responsable d'UE

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Campus

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