

# UE Complex fluids



Level  
Baccalaureate  
+5



ECTS  
3 credits



Component  
UFR PhITEM  
(physique,  
ingénierie, terre,  
environnement,  
mécanique)



Semester  
Automne

- > **Teaching language(s):** English
- > **Open to exchange students:** Yes
- > **Code d'export Apogée:** PAX9NFAE

## Presentation

### Description

#### *Goal*

Complex fluids are mixtures of different materials and fluids. Usually, we consider the coexistence between two phases: solid–liquid (like suspensions or solutions of polymers, proteins or DNA), solid–gas (like granular materials), liquid–gas (like foams) or liquid–liquid (like emulsions). Complex fluids exhibit unusual mechanical responses to applied stress or deformation. The mechanical response includes non-linear behaviors such as shear thinning or shear thickening as well as large fluctuations (elastic turbulence). The mechanical properties of complex fluids can be attributed to characteristics such as polymer unfolding, caging, or clustering on multiple length scales. The course deals mainly with two kinds of complex fluids: polymer fluids and suspensions.

#### *Content:*

1. Introduction to Complex fluids in nature and in industry
  2. Conservation laws. Matter, Momentum and Energy
  3. Standard flows (Poiseuille flow, Couette flow).
  4. Dissipation
  5. Polymer fluids
- Non-linear fluids and shear dependent viscosity
  - Normal stresses and Weissenberg experiment

- From nano to macro: starting from a polymer chain to macroscopic properties
6. Suspensions

- Rheology
- Homogenization
- Taylor dispersion
- Active suspension (natural and artificial nano and micro-swimmers)

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## Course parts

UE Complex fluids - CMTD

Lectures (CM) & Teaching Unit (UE)

22,5h

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## Recommended prerequisites

Basis in hydrodynamics

**Period :** Semester 9

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## Bibliography

Dynamics of polymeric liquids, B. Bird, vol 1 & 2, John Wiley & Sons Ed. 1987

The structure and Rheology of Complex Fluids, Ronald Larson, Oxford Univ. Press, 1999

## Useful info

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### Campus

- › Grenoble - University campus
- › Grenoble - Scientific Polygon