European Commission

Innovative Training Networks
Marie-Skłodowska-Curie-Maßnahmen

1 PhD-Level Open Positions in The Modeling and Simulation of Yield-Stress Fluids

Context

The YIELDGAP project is an Innovative Training Network (ITN – Marie Slodowska Curie action) involving 9 academic and 4 industrial partners from 7 European countries, dedicated to a better understanding of yield-stress fluids (cometics, foams, detergents, biological fluids), from fundamental systems to industrial fluids, using experimental and modelling approaches. This ITN will develop a European multi-disciplinary, intersectoral educational research framework, to comprehensively train 12 early-stage researchers to PhD level, among which the PhD offer described below.

For more information: https://codris.europa.eu/project/id/955605

Job Description

Within the EU project YIELDGAP, we are looking for 1 PhD students to study viscoplastic and elastoviscoplastic fluids. We plan numerical simulations and modelling of the fluid behavior from the basic interactions determining its microstructure. The project exploits highly accurate simulations and state-of-the-art experiments to study complex fluids behavior in industrial processes. We will also model the interparticle interactions and relate them to the macroscopic behavior. The candidate will contribute to develop new numerical tools and analyse theoretical models and experimental results. The candidate will have a chance to collaborate with the groups involved in the EU project YIELDGAP

UNIVERSITY OF PATRAS
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

The Fluids Lab

Examples of Yield-Stress Fluids

Description of the Project

The proposed research is focused on predicting and controlling deformation and flow of a group of complex materials abundant in nature and industry, called Yield-Stress (YS) or viscoplastic (VP) materials. These start to flow when a sufficient stress is applied to them but behave as solids otherwise. A common example is toothpaste, which will not be extruded (flow) until a certain pressure is applied to the tube. The force or yield stress required to initiate their flow plays a significant role in the production, storage, transfer, packaging, and use of YS materials. The conditions for fluid-solid transition along with the position of the fluidization boundary, the "yield surface", play an important role in all related processes.

A patchwork of approaches exists for modeling YS materials across different industries and academia, and there is no consensus which models to apply each time. Hence, the challenge of predicting flows of YS materials clearly exists, despite their wide use, and scientists and engineers today can focus on only a particular material, sector or application. It is imperative to establish a coherent and efficient approach to predict such flows by (a) developing more accurate and general YS theoretical constitutive models, (b) developing advanced algorithms for computing complex YS flows and (c) training young researchers who can generate and apply the above across industrial sectors and academia – **the future European leaders in the field**. In this way, it will become possible to bridge the gap between science and modelling developed in academia (fluid mechanics, rheology, and computational methods) and process engineering (food, chemical, pharmaceutical, oil exploration, construction, etc.) and the gap between existing predictive tools and measurements of real industrial flows or flows in nature (see below).

Originally it was believed that YS materials are just generalized Newtonian fluids, i.e. fluids with a viscosity that depends on the strain-rate when the yield-stress is exceeded. Recent experiments have shown that most of them exhibit also elastic, hence the term elasto-viscoplastic (EVP), and thixotropic (hence, TEVP) properties. The former allows them to partially recover after a deformation and strongly resist extension, while the latter indicates that both their viscosity and yield-stress evolve dynamically along with the flow field. The ideas of Isotropic & Kinematic Hardening (IKH) have been introduced very recently to describe this evolution. Unfortunately, constitutive models (i.e. models which relate the applied stress with the strain-rate), with all these properties are not available yet. The overall goal of this proposal is to develop such models and test them in homogeneous and specific complex and practical flows. The effort will be divided into the following objective.

Your profile

We are looking for talented individuals who are excited about academic research. They should be able to work independently as well as to collaborate with an interdisciplinary team of researchers. Applicants should hold a Diploma in Chemical or Mechanical engineering, Applied Physics or a related field. Good communication skills and fluency in both written and spoken English are required. Analytical, Physical Modeling and Programming skills are expected (e.g. one language among Fortran 2015, C++, Python, Matlab).
During the selection process, candidates will be assessed upon their ability to:

- independently pursue his or her work
- collaborate with others,
- have a professional approach and
- analyze and work with complex issues
- previous experience with large scale simulations, experiments of fluid mechanics problems

Target degree: Doctoral Degree

Eligibility

To be admitted to postgraduate education, the applicant must have basic eligibility in accordance with either of the following:

- passed a degree at advanced level
- completed course requirements of at least 240 higher education credits, of which at least 60 higher education credits at advanced level, or
- in any other way acquired within or outside the country acquired essentially equivalent knowledge
- Requirements for English equivalent to English B/6,
- As this is an ITN EU initiative with a mobility requirement, eligible candidates must not have lived, studied or worked in Greece for more than 12 months in the last 3 years before their recruitment

Supervision

Professor John Tsamopoulos, email: tsamo@chemeng.upatras.gr, phone: +302610997203
Associate Professor Yannis Dimakopoulos, email: dimako@chemeng.upatras.gr, phone: +302610969565

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The Fluids Lab

MARIE CURIE ACTIONS

Founding

H2020-EU - Innovative Training Network (Marie Slodowska Curie Action).

Our research environment

The research of the Fluids Lab (officially the Laboratory of Fluid Mechanics and Rheology) in the University of Patras, Greece focuses on the Rheology of complex fluids and materials that are of Industrial and biological relevance. To establish a more fundamental understanding of their rheological behavior under various conditions, the Fluids Lab investigates the relationship between their rheology and their microstructure using a variety of different methods. For more information, please visit our website:

http://fluidslab.chemeng.upatras.gr/
https://www.chemeng.upatras.gr/en?language=en
http://www.upatras.gr/en

The Fluids Lab is one of the most renowned Labs in the field of Computational Rheology in Europe. We are offering excellent working conditions in a highly international research environment with large computational capacities and access to High Performance Facilities.

Contact Info – How to apply

Please express your interest by electronic mail and preferably in one single pdf-document to Professor John Tsamopoulos in the following address:
tsamo@chemeng.upatras.gr

For full consideration, the application should include

- a cover letter (Maximum 2 pages long)
- a detailed CV,
- a list of possible publications,
- copies of all educational certificates and transcripts in English,
- a summary of past research activities and
- the names of three references.

Academic Partners

KTH Royal Institute of Technology (Swedish: *Kungliga Tekniska högskolan),* Stockholm, Sweden

University of Patras, Greece

École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris, France

Université de Bordeaux, France

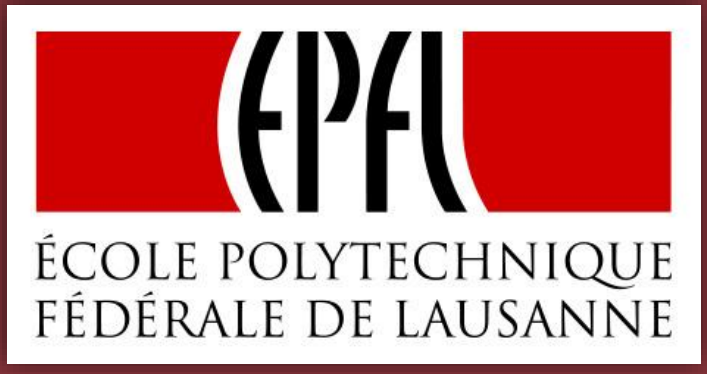
Universita degli studi di Napoli Federico II, Italy

Chalmers University of Technology
Göteborg, Sweden

French National Research Institute for Agriculture, Food and the Environment, France

University of Liverpool, UK

École Polytechnique Fédérale de Lausanne, Switzerland



Industrial Partners

Tetra-Pak
Processing Systems

Solvay

Mycronic

Procter &
Gamble

Rolco Bianil

Key Dates

- **Application Deadline:** until the position is filled
- **Job Starting Date:** according to agreement