PhD position at IFP Energies nouvelles (IFPEN)
in Earth Science - Géoméchanics

Numerical modelling of geomechanical behavior of salt in sedimentary basins by means of a selective S-FEM model

Today exploration in petroleum industry targets more and more complex geological areas characterized by the presence of fault networks and salt. The geomechanical modelisation of these geological objects is a challenge. Salt modelisation in basin models is difficult due to its mechanical behavior: viscous finite deformations at constant volume and abrupt changes in geometry of the salt zones and surrounding rock layers during basin history. The Lagrangian finite element method used in IFPEN basin modeling tools is not well suited to simulating this behavior because strong changes in finite element shape are expected during the simulations due to salt kinematics: the aspect ratio of the elements may surge and the element shape could degenerate causing a degradation of the solution accuracy or making the calculations abort. Expensive re-meshing steps, followed by a solution mapping step, should therefore be done regularly during the simulation. The goal of the thesis is the development of a robust Lagrangian finite element methodology allowing the simulation of salt mechanical behavior in sedimentary basins based on a selective S-FEM approach, which is less sensitive to mesh distortion than FEM and is well suited to taking into account finite strains at constant volume. In order to handle changes in the salt zone geometry, a re-meshing strategy, based on a local splitting of the elements and an implicit description of salt boundaries, will be developed as well. The developments will be carried out in the open source finite element software Code_Aster, developed by EDF R&D.

Keywords: salt tectonics, basin modelling, geomechanics, incompressibility, FEM

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	https://www.universite-paris-saclay.fr/fr/formation/doctorat/sciences-mecaniques-et-energetiques-materiaux-et-geosciences-smemag
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PhD location	IFP Energies nouvelles, Rueil-Malmaison, France
Duration and start date	3 years, starting preferably on September 1st, 2018
Employer	IFP Energies nouvelles, Rueil-Malmaison, France
Academic requirements	University Master degree in mechanics and/or geomechanics
Language requirements	Fluency in French or English, willingness to learn French
Other requirements	Programming skills and inclination to numerical simulation

For more information or to submit an application, see theses.ifpen.fr or contact the IFPEN supervisor.

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IFPEN offers a stimulating research environment, with access to first in class laboratory infrastructures and computing facilities. IFPEN offers competitive salary and benefits packages. All PhD students have access to dedicated seminars and training sessions.