



LMS Seminar

13 June 2024 at 2:00 pm - Room Jean Mandel

Modeling and Simulation of Contact Interfaces: Mechanics of Solids and Fluids Coupled with Transport Phenomena

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ABSTRACT

The contact between two solids occurs over a load-dependent area comprising contact clusters of complex shapes, primarily dictated by the surface roughness of the solids. This roughness encompasses all scales relevant to the problem and generally cannot be separated from the shape of the contacting solids. The complexity of such interfaces is further enhanced by a range of multiphysical phenomena, including heat transfer, fluid flow, and chemical reactions. This presentation aims to provide an overview of our research dedicated to understanding these phenomena and their interplay, with the ultimate goal of gaining deeper insights into meso-scale phenomena such as wear and friction. We will discuss both the technical and physical aspects of this topic. On the technical front, we will explore roughness modeling, introduce the key methods for solving contact problems using boundary and finite element methods, and discuss approaches to compensating for discretization errors. On the physical side, we will share findings on how simplified roughness parameters influence the evolution of the true contact area and the conductivity properties of rough surfaces. Additionally, we will present insights into the impact of fluid flow and trapped fluid within contact interfaces, highlighting the effects of roughness. The presentation will conclude with a discussion on future challenges and opportunities in the field.

BIOGRAPHY

Vladislav A. Yastrebov is a tenured CNRS research scientist specializing in micromechanical contact modeling, surface roughness, and frictional instabilities. He completed his BSc (2005) and MSc (2007) degrees in Applied Mechanics at the St Petersburg Polytechnic University, Russia, and worked as an engineer in the R&D, Modeling and Simulation Department at the Corning Research Centre. He pursued his PhD in computational algorithms for contact problems at MINES Paris, Centre des Matériaux, under the supervision of Georges Cailletaud and Frédéric Feyel, successfully defending it in 2011. Following two postdoctoral positions, one examining the origins of friction at EPFL, Switzerland, with Professor Molinari's group, and another in France investigating dislocation dynamics, Vladislav joined the Centre des Matériaux as a CNRS Research Scientist in 2013. His research has since spanned a wide array of topics related to contact mechanics, including electric contact, basal sliding of glaciers, iceberg/glacier interaction, metal-to-metal sealing, coupled fluid-solid and thermomechanics in contact interfaces, wear of drilling tools, tire grip, tool wear, micromechanical modeling of cemented tungsten carbides, and the development of advanced numerical methods for tackling contact and friction issues via finite and boundary element methods.

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