Postdoc Offer one year starting in Fall/Winter 2017-2018: "Optimization of Sliding Precursors in a multi-contact problem" at laboratory LaMCoS – INSA Lyon, France

Project description:
Polymer substrates coated with stacks of thin layers (metallic, oxide or organic) are increasingly used in many industrial applications such as flexible opto- and microelectronics (screens, OLED, photovoltaic, artificial skin, mechanical gripper, intelligent clothing, etc.). In many of these applications, these coated systems are close to the surface and are subjected to contact stresses. If the case of static contact is relatively well treated in the literature, it can be seen that the problem of the onset of slipping in these systems is little or not addressed. Nevertheless, this problem is of major interest, notably in the biomimetic mechanical gripping or artificial skin systems which are booming in recent years. The project proposed here focuses on the study of slipping precursors in patterned interfaces. It is financed by Carnot Institute Ingénierie@Lyon and its goal is to use and optimize surface patterning either to disrupt or to anticipate the rupture dynamics of an interface within a contact, to allow the emergence and detection of precursors to sliding sufficiently in advance before global sliding. To achieve this goal, we will take advantage on the complementarity of two laboratories specialized in tribology in Lyon area (LTDS and LaMCoS). The problem will be tackled by coupling an experimental point of view and relevant numerical simulations at different scales.
The postdoc will perform at laboratory LaMCoS a multi-scale theoretical study of the strain fields for different contact configurations: single- and multi-contact, with or without adhesion. This theoretical study will be done in parallel with an experimental study of the sliding behavior of sheared interfaces performed at laboratory LTDS by a PhD started in june 2017.

Objectives of the Postdoc :
The aim of the one-year Postdoc is to address the theoretical part of the work. The multi-scale approach will be composed of three well defined complementary parts: a Molecular study part allowing to identify surface forces and strain fluctuations at the nanometer scale, a semi-analytical part based on the locally developed code ISAAC to address the contact problem in a continuum description at the micrometer scale, and homogenization calculations based on the previous results to solve the multi-contact problem. The goal of the postdoc is to identify an order parameter able to predict sliding between surfaces, and then to optimize the shape of the surfaces (roughness, friction or adhesion) in order to amplify the signal.

Available material ressources:
The financement of the postdoc includes an accompanying budget to allow participations in international congress and devoted office computing tools. Moreover, LaMCoS provides a calculation cluster with 232 cores, 1 To RAM and high power computing.

Profile of the candidate: Young researcher with a solid formation in theoretical physics of condensed matter and/or theoretical mechanics, and with a proven experience in numerical simulations. Candidates with past experience in Molecular Dynamics simulations of polymers will be prefered. Additional skills in contact mechanics/micro-mechanics/adhesion/homogenization tools will be appreciated.

The supervising staff is composed of specialists in molecular dynamics simulations for mechanical systems (Anne Tanguy and Nicolas Fillot at LaMCoS), developer of the semi-analytical code ISAAC for contact problems (Daniel Nélias, director of LaMCoS), and a specialist of homogenization calculations (David Dureisseix at LaMCoS).

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