

PhD position at the University of Strasbourg at ICube.

Finite element simulation and contact mechanics.

Starting date: From December 1st 2024 or later (Deadline for starting date: June 2025).

Duration: 36 months.

PhD Director: Prof. Christophe FOND (ICube)

Co-Directions: Prof. Maurice BROGLY (Mulhouse University), Dr. Olivier NOEL (Le Mans university)

Collaboration: Bruker (Paris and Praha)

Financial Support: ANR – **MECASOFT** project – Standard Grant.

Location: Strasbourg University - ICube

Subject:

The MECASOFT project will focus on soft materials, *i.e* whose moduli are below the MPa. This concerns materials such as elastomers, gels, tissues, and cell membranes. In a first step, finite element simulation will consider homogeneous non-adhesive elastic materials and will scrutinize the surface tension effect regarding the contact mechanics. Neither substrate nor boundary dimensional effects will be investigated. In the next steps, the simulation will integrate the viscoelastic properties of the material, the role of adhesion at the interface between the indenter and the sample. Given that these issues are still unsolved, the problem will be addressed by considering large displacement continuum mechanics approach. To this end, simplified general laws are expected.

This project will also concern instrumental developments and associated procedures at the micro and nano-scale to validate the new contact mechanics models and to determine experimentally the local mechanical properties of microscopic/nanoscale objects or thin films.

The final aim of the project is to provide the international contact mechanics community (but also to indentation device suppliers and industrials) with original and operational contributions. Operational means that our approach does not focus on a specific material with specific properties, but we expect to give relevant laws as universal as possible for elastic or viscoelastic materials (adhesive contact or not) to get a simple comprehension and reasonable estimates of the involved mechanisms in micro/nano indentation experiments.

Candidate skills:

The recruited student will be involved exclusively in finite element simulation regarding contact mechanics issues. He/she will also be required to communicate with the project's experimental partners to compare the models with the experimental approach.

Skills in simulation or modeling (preferably in finite element simulation) are mandatory. Knowledge in contact mechanics or basic mechanics would be appreciated.

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