

Post-Doctoral position (1 year):

Mechanical multiscale modelling of the bone-implant interphase

Key words

Mechanics, Numerical Simulation, Homogenisation, Multi-scale, Implants & Bone

Background and objectives

Bone is a living tissue able to adapt to its environment such as the presence of implants, widely used in maxillofacial, dental and orthopaedic surgeries. Implants long-term stability is determined by adequate osseointegration, *i.e.*, new bone growing around and onto the implant surface. A complex combination of biomechanical properties (structure, composition, mechanics) and a hierarchical structure spanning from the nano- to the macroscale define the quality of the interfacial bone tissue and condition the resulting interphase strength. However, we still know little about how these properties evolve, both spatially (around the implant), and over time (as healing progresses and bone is remodelled), and how they impact the mechanical resistance of the bone-implant system. Based on existing work, this postdoc will propose a multiscale model to explore how nanostructure and composition of the interfacial bone tissue evolve and drive the resulting mechanical strength of the interphase.

Approach

The postdoc will be in charge of adapting and further developing homogenisation models of the bone interfacial tissue, and will collaborate with researchers conducting experiments to characterise the nanostructure and nanocomposition of the tissue. The objective is to identify key relationships driving the (bio)mechanical response of the interphase, spanning the hierarchical scales of the biological tissue, in relation to real data.

Research environment

The project involves primarily numerical modelling work. It will take place at the Biomechanics team of the research laboratory MSME (Multi-scale Modelling and Simulation), Université Paris-Est Créteil, in Créteil (campus Centre). There will be a tight collaboration with the MSSMat (Soil, Structure and Material Mechanics, CentraleSupélec, campus Paris-Saclay), with surgeons (Hospital Henri Mondor, Université Paris-Est Créteil) as well as with a start-up company WaveImplant.

Candidate profile

Applications are invited from interested and motivated researchers with a PhD in (bio)mechanics or physical engineering with background in mechanical modelling. Experience in numerical modelling, programming and mechanical testing is highly advantageous. An interest in biomechanics, imaging and/or nanophysics will be a plus. Moreover, ability to express yourselves in English and/or French in speech and writing is a requirement, and the ability to work independently is considered highly important. Motivation, curiosity as well as interest in medical applications will be appreciated.

Details and contact

Interested candidates are invited to contact Dr Sophie Le Cann and to submit their applications to sophie.le-cann@u-pec.fr (please include letter of motivation, CV, publication list, degree certificate, and name and contact information to at least one referee).

The Postdoc is for 12 months, starting in the fall 2021 (oct-nov).

07/07/2021