Contexte et atouts du poste

Ischemic stroke is a major cause of disability and death worldwide. The occlusion of blood vessels results in a potentially large area of the brain to be oxygen deprived. Recent clinical trials have demonstrated Endovascular Thrombectomy (EVT) to be highly effective, which has led to its widespread adoption in clinical routine. However, the international medical community recommends that the EVT is performed within 3 hours after the patient has arrived at the treatment center. Part of this objective can be fulfilled by making the treatment faster and more secure.

PresPIN is an ANR-funded project that aims at providing the interventionalist with predictive simulation tools to make planning the phase more efficient and thereafter both reduce treatment time and improve patient outcome. The manipulation of a catheter to navigate through the blood vasculature is at the core of EVT and beyond: it is the fundamental skill that is required from a practitioner in Interventional radiology. The difficulty is to leverage complex physical behaviors such as the torsion and the elasticity of the catheter, as well as the catheter reaction to the contact it may have with the arterial wall.

Mission confiée

The current project aims at designing a new simulation framework able to tackle the complex boundary conditions at interactive rates, in actual patient vasculature. Several models have been investigated to simulate the catheter in this procedure (mass springs, beam FEM, Cosserat model). Besides, the blood vessel surface is generally represented as a mesh. But these models still have a hard time predicting the behavior of the catheter. This framework will combine and leverage the respective properties of a Cosserat model for the catheter [Wai17, Vil20] with an implicit representation for the blood vessel surface (Ker17).

The candidate will be assigned the design of innovative 3D and 1D object models and contact management algorithms.

These developments will benefit from segmentation advances from a research partner, and will be used to improve blood flow simulations by another partner. Besides, a later phase of the project will leverage engineering and clinical resources to develop and validate a software simulator to demonstrate our work. As a consequence, the candidate will need to connect and interact with contributors with various background.

References:


Avantages

- Unsubmited meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
Rémunération
Monthly salary after taxes: around 1596,05€ for 1st and 2nd year. 1678,99€ for 3rd year. (medical insurance included).