SOUTENANCE DE THESE

THESIS DEFENSE

Benjamin SEVENIE

Unité de Recherche **: Laboratoire BMBI, Labex MS2T**

soutiendra sa thèse de **Doctorat** sur le sujet **:**

Dynamics of a deformable capsule flowing in a bifurcated microchannel

A l'Université de Technologie de Compiègne

Le lundi 20 Juin 2016 à 14h00

Amphi L103 – Centre Pierre Guillaumat

Devant le jury composé de :

- **Mme BALABANI Stavroula**, Reader, Thermofluides, University College London, Royaume-Uni
- **M. CUETO Elias, Professeur,** Université de Saragosse, Zaragoza, Espagne
- **M. IBRAHIMBEGOVIC Adnan,** Professeur des universités, UTC - laboratoire Roberval, Compiègne
- **Mme LORTHOIS Sylvie,** Directrice de recherche CNRS, Institut de Mécanique des Fluides de Toulouse
- **Mme SALSAC Anne-Virginie,** Chargée de recherche CNRS, UTC - laboratoire BMBI, Compiègne
- **M. VILLON Pierre,** Professeur des universités, UTC - laboratoire Roberval, Compiègne
- *Invitée :* ***Mme BARTHES-BIESEL Dominique,*** *Professeur émérite, Université de Technologie de Compiègne, laboratoire BMBI*

Abstract :

The motion and deformation of a liquid-filled elastic microcapsule flowing in microchannels is investigated both experimentally and numerically.

Capsules are first investigated when flowing in a straight microfluidic channel with a square cross-section. The objective is then to investigate whether it is possible to determine the mechanical properties of the capsule membrane from their hydrodynamic deformation. A method of identification has been devised to compare the particle deformed shape measured experimentally

Convention ANR-11-IDEX-0004-02

www.labexms2t.fr

in the microchannels to the ones predicted for the same configuration by a three-dimensional numerical model. After having tested the precision of the inverse analysis algorithm and verified whether it is robust enough to provide results even when the microfluidic channels slightly depart from pure squareness, we have applied the method on microcapsules with a membrane made of reticulated ovalbumin and determined their mechanical properties. A Proper Orthogonal Decomposition (POD) of the capsule shape has then been used in order to provide a new technique in the future to interpolate the capsule deformed shape.

Capsules have then been investigated flowing in a bifurcated microchannel. Qualitative results of the motion and deformation of capsules in such channel have been obtained. A semi-automatic contour detection program has been developed in order to improve the image analysis. The POD method has been applied to the experimental results proving the feasibility of building a reduced-order model of the phenomenon by using a POD reduced basis.

Thesis funded by the Labex MS2T