Soutenance de thèse

Julien LALLEMENT soutiendra sa thèse de doctorat, préparée au sein de l'équipe d'accueil doctoral ISAE-ONERA EDyF et intitulée «*Modélisation et simulation numérique d'écoulements de films minces avec effet de mouillage partiel*»

Le 08 février 2019 à 14h00, Auditorium de l'ONERA Toulouse

devant le jury composé de

M. Philippe VILLEDIEU	Directeur de recherche ONERA Toulouse	Directeur de thèse
M. Pierre TRONTIN	Ingénieur de recherche ONERA Toulouse	Co-directeur de thèse
M. Christian RUYER-QUIL	Professeur Université de Chambéry	Rapporteur
M. Laurent LIMAT	Directeur de recherche laboratoire MSC	Rapporteur
M. Philippe BELTRAME	Maître de conférences Université d'Avignon et Pays du Vaucluse	
Mme Claire LAURENT	Ingénieure de recherche ONERA Toulouse	

Summary:

The objective of this work is to model motion and instabilities of partially wetting thin liquid films. Emphasis is put on the numerical treatment of capillary forces, especially those acting in the vicinity of the contact line, since they can strongly influence the development of instabilities. The main idea of the work consists in reformulating the shallow water equations by introducing a "disjoining pressure" to model partial wetting effects. This new term allows smoothing the singular force acting at the contact line by replacing it by a distributed force. Based on the work of Noble & Vila, we use an augmented conservative system that consists in reducing the order of the shallow water system by adding one evolution equation. This model is suited for numerical purposes since the surface tension term only involves second order derivatives instead of third order derivatives. In addition to that, it is possible to write energy balance equation corresponding to this model that implies the conservation of the energy. The existence of this energy balance equation was used as a criterion to build our system with partial wetting effects. One-dimensional numerical simulations using a first order implicit finite volume scheme have been performed. Droplet's stationnary shape and spreading length on an horizontal substrate is well recovered. Moreover, based on a linear stability analysis, stable and unstable dewetting regimes of a finite film of uniform thickness can be identified and simulated

Keywords: fluid dynamics, applied mathematics, multiphase systems