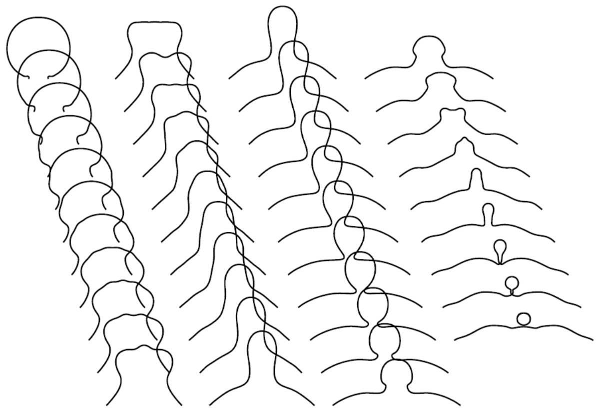 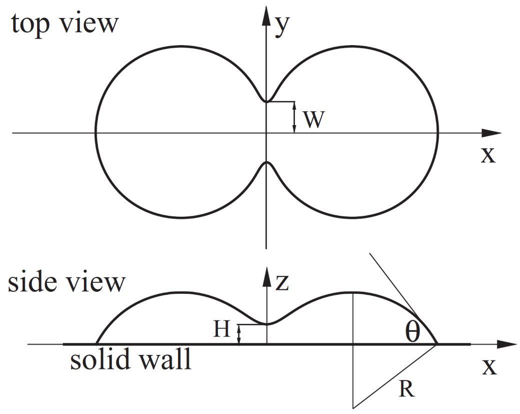

Title: Rapid spreading and coalescence of droplets on a substrate

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http://lmfa.ec-lyon.fr/index.php?p_id=perso.066.000.000

Abstract: The conditions in small regions near moving contact lines usually control flows wherein these occur on a large scale. Some fundamental difficulties with the description of the flow near moving contact lines will be reviewed briefly first in this seminar, along with some key models that have been proposed to circumvent these (including the use of a slip condition). Numerical simulations (VOF, level set, or otherwise) using any of these models normally still requires resolving the flow on a large range of length scales, potentially down to the limit of a continuum description, which is computationally prohibitive. Nevertheless, results obtained with such an approach will be presented for the simulation of the coalescence of two droplets on a substrate, wherein a new self-similar regime is identified, which are found to agree well with a theoretical analysis.

In the second part of this seminar, single droplet spreading is considered further. Some interesting features of rapid spreading will be presented, including pinch-off of a satellite droplet, and a cascade of pinch-off events. A detailed analysis is available for slow spreading, based on a slip model. The corresponding description of rapid spreading must account for inertial effects that can upset the structure of the flow around the contact line. Progress on this has been made recently, by using numerical simulations to test and modify an analytical viscous/inertial theory of Cox. A large range of length scales is simulated by using adaptive mesh refinement and assuming axisymmetry. Furthermore, it has been possible to formulate a practical model that does not require extreme numerical resolutions, by using this modified theory. Further challenges include the extension of these approaches to 3D, and accounting for further complexities.

The above figures have been taken from H. Ding et al., Journal of Fluid Mechanics (2011) and Y Sui et al., Physics of Fluids (2013), respectively.