Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Modeling sessile droplets on hydrophobic surfaces with spatially varying contact angle OISTEIN WIND-WILLASSEN, MADS PETER SORENSEN, Technical University of Denmark — We present a mathematical model that we have developed in order to numerically investigate droplets deposited on hydrophobic surfaces with spatially varying contact angle, $\theta(\mathbf{r})$. If a gradient in θ is induced on the surface it is possible to guide the flow. The model solves the Navier-Stokes equation on a time-dependent domain $\Omega(t)$ by the use of the Finite Element Method with a moving mesh (Arbitrary Lagrangian-Eulerian, ALE). A Navier slip boundary condition at the fluid-solid interface has been implemented, and at the free surface the Young-Laplace equation is used. Results for 1) drops deposited on an inclined plane will be presented, along with 2) results for a drop oscillating in a "potential well" made from rapidly (but smoothly) changing the contact angle. In case 1) we examined the internal flow field of the drop and, according to the model, a rotating flow builds up as the overall velocity increases. In case 2) the drop oscillates in a damped way since viscous friction damps out the energy. There seem to be a non-linearity between the strength of the potential and the amplitude, decay length, and frequency of the oscillations. We suspect this is due to some preferred internal oscillatory state/eigenmode of the drop.

Oistein Wind-Willassen
Technical University of Denmark

Date submitted: 23 Jul 2012 Electronic form version 1.4