

Adaptive Flow Modelling for Coupled Thin Film and Bulk Fluid Flow

Pratik Suchde*

* University of Luxembourg
2 Av. de l'Universite, 4365 Esch-sur-Alzette, Luxembourg
E-Mail: pratik.suchde@uni.lu

ABSTRACT

Various thin film flow models have been proposed in literature to study the flow of fluids in thin layers. These models have been widely used when the thin fluid film is only object of interest. However, these models are not applicable when a bulk flowing fluid hits a curved surface, and forms a thin layer of fluid over it. Such scenarios commonly occur, for example, in cleaning processes in the food industry. Simulations of such flow typically rely on bulk (3D) fluid models, with excessively fine resolutions in the thin flow regions, which make them prohibitively expensive.

In this talk, we present a novel adaptive fluid modelling framework to simulate coupled bulk-surface fluid flow. The proposed framework uses a traditional 3D Navier--Stokes model for bulk fluid flow, and switches to a pseudo 2D thin film flow model when appropriate. The method automatically identifies regions where the thin film model is applicable, and adaptively changes the fluid model used. In this talk, we will discuss how the model adaptivity is achieved, and how mass conservation is ensured when switching between the two models. Numerical results are verified against fine bulk simulations. Applications to cleaning simulations in the food industry, and rain-on-car simulations are also presented.