

## 1. Computational Fluid Dynamics (NMSC Group)

### *Modeling and Simulation of Multiphase Flows*

Free surface and two-phase flows are encountered in many applications such as spray cooling, surface coating, lab-on-a-chip, cooling in nuclear reactors, etc. The accurate numerical computation of interface flows is still a challenging task. An important issue is the precise inclusion of the surface force which compresses the surface tension and the local curvature of the free surface/interface. In addition, the presence of non-uniform distribution of surfactants on the interface induces Marangoni forces. Further, adsorption and desorption of surfactants between the interface and the bulk phase increase the complexity of the numerical computations.

### *Modeling and Simulation of Turbulent Flows in Time-dependent Domains*

Apart from other challenges associated with the computations of PDEs in time-dependent domains, the presence of turbulence in the flow induces a lot of challenge in computations. In particular, standard numerical methods fail, and advanced turbulent models are necessary.

The aim of this project is to develop an efficient and robust turbulent models for simulating turbulent flows in time-dependent domains. This project also involves implementation of the developed numerical scheme in our in-house finite element package ParMooN.

**Research Areas:** *Computational Mathematics; Turbulent Flow Modeling; Finite Element Methods; Moving boundaries*

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