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ENERGY PRESERVING MULTIPHASE FLOWS: APPLICATION TO FALLING FILMS.

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The numerical simulation of multiphase flows presents several challenges from a modeling perspective, namely the capture of a moving interface and the proper calculation of curvature are relevant obstacle to include surface tension effects. In addition, the inclusion of the aforementioned within a physics-compatible framework presents a major challenge within multiphase computational methods. Namely, the imbalance between kinetic and elastic energy in the presence of surface tension is an open question and prone to numerical instabilities.

In order to tackle this issue, symmetry-preserving ideas [1] have been used to set the mathematical grounds of the energy conservation in the context of fluid flow simulations. Those provide with a high degree of physical reliability, but also with improved stability. On the other hand, the framework of the well-known (mass) Conservative Level-Set method [2] has been adopted for capturing the moving interface. Equipped with these techniques, the conservation of total energy for multiphase flows was recently addressed in [3] to produce an energy-preserving method for multiphase flows. The energy-preserving method will be presented along with a brief discussion on the conservation of linear momentum.

This numerical technique will be used to assess the flow topology of a falling film. Relevant in industry, falling films present instabilities ruled by surface tension. These instabilities have an impact on both heat and mass transfer phenomena [4]. From this perspective, this flow configuration presents not only an academically stimulating problem, but also an industrially relevant problem. In view of the foregoing, simulation of typical falling films by means of [3] are being carried out at MareNostrum IV and will be presented as well.

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