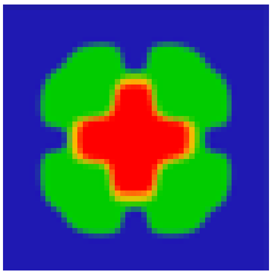

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Fluid-Structure Interaction: simulating the cavitation phenomenon

Tuesday, July 24, 2018 11:00 AM (20 minutes)

It has been recently shown that a Diffuse Interface model is able to fully describe the dynamics of multiphase flows. In particular, the possibility of deriving a set of equations addressing the dynamic of the entire domain of simulation, makes it ideal to describe phenomena such as vapor bubble dynamics in a surrounding liquid. The model is able to capture surface tension effects, phase changes (condensation and evaporation) and even transitions to supercritical conditions, bubble collapse stages and the related shock-wave emissions. The diffuse interface model is intrinsically multiscale, enabling the study of all the characteristic size of the bubbles (from nm up to mm of radius) and the typical frequencies of evolution (of order 1-100 MHz). Moreover, the numerical simulations gives access to all the fields, anywhere in the domain, in particular predicting the pressure and thermal loads on the nearby solid walls.
A main application we are interested in is the cavitation phenomenon (implosion of vapor bubbles near solid surfaces), in order to take advantage of the high mechanical stresses (for biomedical applications, e.g.) or prevent them (to reduce or prevent structural damages). A full understanding of this complex phenomena requires, on one hand, a full description of the fluid part, and on the other hand, a suitable modeling of the solid dynamics with particular attention to plasticity and damage analysis. In this context, the use of the deal.II library could help thanks to its ability in automatically refining the mesh (i.e. in solving the smallest scales involved in the dynamics), and thanks to the large implementation possibility, already offered from the structural point of view, in terms of plasticity models.

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