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Simulations of a heated fluid at low Mach number: modelling of phase transition and numerical strategies

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Thermohydraulic codes used in industry are based on the resolution of compressible Navier-Stokes equations in which acoustic waves are taken into account. This allows to describe fluid flows at any Mach number. However, many difficulties may arise in terms of CPU time, robustness and accuracy in the low Mach number regime.
In this regime, an asymptotic expansion with respect to the Mach number leads to simpler models.
Thus, the strategy of our work is to derive, investigate and simulate a system of PDE taking into account phase transition in the low Mach number regime but with possible high heat transfers.
More precisely, we focus on the choice of the equation of state and its parameters, with emphasis on the gain due to the low Mach number hypothesis,
and we present preliminary 2D numerical simulations with FreeFem++ showing the robustness of the approach.
This is a joint work with S. Dellacherie, G. Faccanoni and Y. Penel.

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