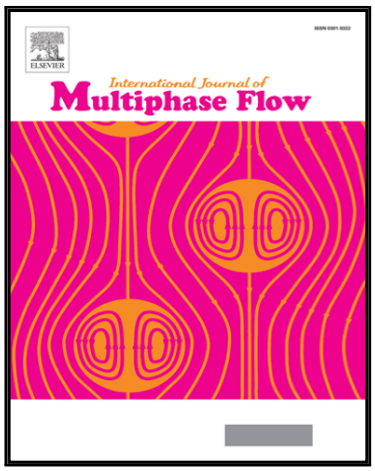

Computational modeling of freezing of supercooled water using phase-field front propagation with immersed points

Edin Berberović, Markus Schremb, Željko Tuković, Suad Jakirlić, Cameron Tropea

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Highlights

- Development of a new computational framework for modeling the solidification of supercooled liquid water.
- Utilization of the combination of the phase-field front propagation approach with the thermal diffusion equations in the phases.
- Decoupling at the moving phase-interface by using immersed points to impose the melting/freezing temperature at the interface.
- Robust and efficient implementation within the object-oriented framework in foam-extend, the extension of OpenFOAM®
- Extension of the numerical model to include conjugate heat transfer with the neighboring, thermally coupled solid wall.
- The validation of the numerical model demonstrates that it has a good capability to compute the solidification in the absence of walls, or far from the wall.
- At the wall, the problem formulation imposes a singularity as a fundamental difficulty at the triple contact line, formed during solidification of liquid over a solid substrate, which is also confirmed.
- The numerical model can be used as a framework for investigations of the interaction of the solidifying supercooled water with the thermally coupled solid substrate, by inclusion of and combining with suitably formulated plausible models, which would eventually remove the singularity.