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Modelling flash-boiling atomisation with the homogeneous relaxation model implemented in a fully compressible solver KONSTANTINOS LYRAS, SIAKA DEMBELE, Kingston University London, JENNIFER WEN, Warwick university — Sudden depressurisation of superheated liquids through nozzles is a major challenge. This pressure drop together with the rapid phase change of the liquid are important characteristics of flashing. The resulting jet usually emerges to the low-pressure region with a high velocity and fragments to large blobs and ligaments and then droplets due to both mechanical and thermodynamic effects. The present study presents a numerical approach for simulating the atomisation of flashing liquids accounting for the distinct stages, from primary atomisation to secondary break-up to small droplets using the Eulerian-Lagrangian-Spray-Atomisation model coupled with the homogeneous relaxation model. The proposed approach has the advantage of avoiding the unrealistic common assumption of pure liquid at the nozzle exit. It models the change in the regime inside the nozzle treating flashing in a unified approach simulating the metastable jet both inside and outside the nozzle. Important mechanisms such as thermal non-equilibrium, aerodynamic break-up, droplet collisions and evaporation are modelled in a novel atomisation model. Results for turbulent flows for both subcooled and superheated liquids are presented showing that the proposed approach can accurately simulate the primary atomisation.

Konstantinos Lyras
Kingston University London

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