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Modelling and Investigation of Phase Change Phenomena of Multiple Water Droplets

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Abstract : In recent years, the research of heat transfer or phase change phenomena of liquid water droplets experiences a growing interest in aircraft icing, power transmission line icing, marine icing and wind turbine icing applications. This growing interest speeding up the research from single to multiple droplet phenomena. Impingements of multiple droplets and the resulting solidification phenomena after impact on a very cold surface is computationally studied in this paper. The model used in the current study solves the flow equation, composed of energy balance and the volume fraction equations. The main aim of the study is to investigate the effects of several thermo-physical properties (density, thermal conductivity and specific heat) on droplets freezing. The outcome is examined by various important factors, for instance, liquid fraction, total freezing time, droplet temperature and total heat transfer rate in the interface region. The liquid fraction helps to understand the complete phase change phenomena during solidification. Temperature distribution and heat transfer rate help to demonstrate the overall thermal exchange behaviors between the droplets and substrate surface. Findings of this research provide an important technical achievement for ice modeling and prediction studies.

Keywords : droplets, CFD, thermos-physical properties, solidification
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