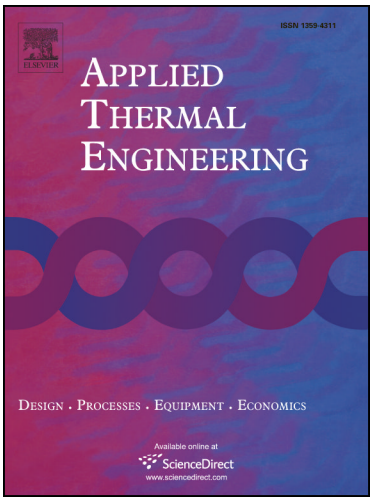

Research Paper

Numerical study of high-overload effect on liquid film of spray cooling

Pang Liping, Luo Kun, Guo Qi, Li Shuxin, Yang Chao

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Numerical study of high-overload effect on liquid film of spray cooling

Pang Liping *, Luo Kun, Guo Qi, Li Shuxin, Yang Chao

School of Aviation Science and Engineering, Beijing University of Aeronautics and Astronautics, Beijing 100191, China

Email address of the corresponding author is: pangliping@buaa.edu.cn.

Abstract

A tow-dimensional numerical model was developed to study a heat and mass transfer process of liquid film formed by a row of droplets under high-overload conditions. The model was solved using the Volume of Fluid (VOF) method. Simulation cases were carried out with different droplets velocities and overload accelerations. The liquid film flow as well as no-phase-change heat transfer were studied during droplets hitting the flat surface. The simulation results obtained under high-overload and normal gravity conditions are compared to reveal the impact of acceleration on the heat and mass transfer performance. The analyses indicate that the average temperature of heated surface, T_{sur}, decreases with the increase of the droplet velocity under the normal gravity. While under horizontal high-overload conditions, T_{sur} decreases first and then increases with the increase of the droplet velocity. T_{sur} under horizontal high-overload is lower than the one under the normal gravity. When the droplet velocity is relatively high, the vertical overload acceleration has little influence on T_{sur}. However, when the droplet velocity is relatively low under vertical high-overload, weightless or overweight condition makes T_{sur} increase or decrease, respectively. The reason to cause this temperature change is that the shape of liquid