replacing DFD17-2017-002094.

Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Numerical simulations of an impinging liquid spray in a cross-flow

SREEKAR GOMATAM, Research Scholar, Dept. of Applied Mechanics, Indian Inst of Tech-Madras, VENGADESAN S[1], CHAKRAVARTHY S R[2], Professor — The characteristics of a liquid spray in a uniform cross-flow field are numerically simulated in this study. A hollow cone liquid spray is injected perpendicular to the air stream flowing through a rectangular duct under room temperature and pressure. An Eulerian-Lagrangian framework is adopted to simulate the spray in cross-flow phenomenon. The cross-flow velocity is varied from 6-12 m/s while the liquid injection pressure is varied from 0.3-0.6 MPa. The liquid droplets from the injected spray undergo breakup and/or coalescence further in the cross-flow. Moreover, the spray injected into the cross-flow impinges on the opposite wall resulting in the formation of a liquid film. This liquid film disintegrates further into discrete droplets because of the impingement of the droplets from the spray and the shear from the cross-flow. The overall distribution of the droplets in the cross-flow for varying conditions is studied in detail. The evolution of the liquid film with space and time for varying conditions is also investigated. Suitable sub-models are used to numerically model the droplet break-up, coalescence, liquid film formation and disintegration, splashing of the droplets on the film and subsequent formation of daughter droplets.

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Date submitted: 01 Aug 2017 Electronic form version 1.4