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DESUPERHEATER NOZZLE SYSTEMS SPRAY MODEL FOR DROPLET SIZES BASED ON THE LINEAR INSTABILITY SYSTEM ANALYSIS

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Abstract
The droplet size prediction in Desuperheater Nozzlespraysis regarded as one of the key issues in industrial applications. Analytical model for calculating the Volume Average diameter of water particle sizes produced by the breakup of spray nozzle liquid is arrived and validated by the experimental measurements and Computational Fluid Dynamics for different types of Spray Nozzles with different Sizes. This work predicted the average water particle diameter in sprays according to the various boundary setups of the desuperheater nozzles. The model projected is based on the linear theory formulation coupled with criteria about the particles expansion. The first process in modeling is solving a modified dispersion equation, known as wavebreakup model derived from the linearization of the Naiver-Strokes equations. Then, a simple equation to predict the Volume Average Particle Diameter from the instability analysis is defined for Spray Nozzles in Desuperheaters spray nozzles. An iterative technique is followed for the maximum value of the rolling rate for the disturbance wave length. A simple correlation is adopted to determine the resulting average diameter of the particle with respect to the function of nozzle diameter and the most unstable dimensionless wave number corresponding to the maximum growth rate of the sprays particles. The analytical model is arrived by comparing the analytical results with the experimental measurements and computational fluid dynamics for a set of nozzles at varied operating conditions. Phase Doppler Particle analyzer (PDPA) is used for measuring the size of particles sprays with measuring point located near nozzle tip in order to capture formed particles just after spray. The comparison showed a good settlement between the analytically calculated Volume Average diameter of spray particles and corresponding experimental and computational measurements.

Author Keywords
Spray breakup mechanisms, Model breakup, Spray particle diameter, Linear instability system analysis, Computational fluid sprays experiments

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Computational Fluid Dynamics, Desuperheater Nozzles, Naiver-Strokes equations.

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