Phase Doppler Interferometry Volume Flux Calculation Optimization and Comparison with Nominally Point Mechanical Patternation Techniques

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Abstract

Characterization of the volume flux distribution for a spray is a first order determinant for evaluating spray performance. The phase Doppler interferometer instrument has been well established as a means for accurately and reliably measuring drop size and velocity distributions in sprays. Utilizing these spray characteristics combined with local number density (concentration), the phase Doppler interferometer can provide a nonintrusive, in situ volume flux measurement. With the advancement of the phase Doppler Interferometry technique, the evaluation and comparison of instrumentation capable of measuring volumetric flux is an important step in validating these data for a wide range of industrial spray applications.

In the current study, experimental results of volume flux were acquired using Mechanical Patternation (MP) and Phase Doppler Interferometry (PDI) techniques. The baseline measurements in the present study were obtained using mechanical patternation of a hydraulic, low capacity, flat fan spray nozzle. Through controlled testing methods, the Artium PDI system, which incorporates the Artium AIMS *auto setup* software, was shown to very accurately determine the volume flux for the spray nozzle at multiple locations within the spray plume as well as D_{30} and velocity results. Additionally, the effect of receiver lens selection, slit aperture, and PMT gain were examined. Volume flux agreements as high as 98.8% were acquired between the MP point method and the PDI, when appropriate setup methods were implemented.

Key words: Phase Doppler Interferometry, PDI, Mechanical Patternation, Volume Flux, Number Density, Experimental Validation, Experimental Comparison, Droplet Trajectory, Probe Volume

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