Air blasted spray controlled by a synthetic jet actuator

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Abstract: Sprays are one of the basic elements in many industrial processes such as combustion in direct injection engines and gas turbines, manufacturing procedures, agriculture and many other sectors. The development of an active flow control able to manipulate the mixing and atomization phases as well as their characteristics is a necessary target to enhance the efficiency of sprays.
A first basic attempt to control a spray was carried out by Pavlova et al. [1], who investigated the effects of a single synthetic jet on an air atomized solid cone spray. They introduced a dimensionless momentum coefficient to quantify the control effectiveness of the device, which meaningfull for diluite sprays, as it does not take into account possible the different densities of air and spray liquid. The present contribution aims to generalize the theoretical approach and is devoted to designing and manufacturing a synthetic jet actuator able to influence the base parameters of an air blasted spray.
All the operating characteristics (namely, resonance frequencies and jet exit velocity) of the actuator are predicted by means of the use of the numerical code developed by de Luca et al. [2]. The effect of the synthetic jet actuation on global spray features has been evaluated by means of particle image velocimetry (PIV) and phase doppler anemometry (PDA). Preliminary measurements show that the synthetic jet not only vectorizes the spray, but it modifies also the aperture cone of the mixing, as well as it influences the droplets size and their distribution.

Keywords: Active flow control, Spray, Synthetic jet devices

References

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