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Spatially-resolved, three-dimensional spray characterization of impinging jets by digital in-line holography JIAN GAO, NEIL RODRIGUES, PAUL SOJKA, JUN CHEN, Purdue University — The impinging jet injector is a preferred method for the atomization of liquid rocket propellants. The majority of experimental studies in literature are not spatially-resolved due to the limitations of widely available point-wise and two-dimensional (2D) diagnostic techniques such as phase Doppler anemometry (PDA), which requires significant experimental repetitions to give spatially-resolved measurements. In the present study, digital in-line holography (DIH) is used to provide spatially-resolved, three-dimensional (3D) characteristics of impinging jet sprays. A double-exposure DIH setup is configured to measure droplet 3D, three-component velocity as well as the size distribution. The particle information is extracted by the hybrid method, which is recently proposed as a particle detection method. To enlarge the detection volume, two parallel, collimated laser beams are used to simultaneously probe the spray at two locations, and two identical cameras are used to record the corresponding holograms. Such a setup has a detection volume of approximately 20 cm by 3.6 cm by 4.8 cm. Sprays of both Newtonian and non-Newtonian liquids corresponding to regimes at relatively lower jet Reynolds and Weber numbers are investigated. Measurements from DIH are further verified by comparison with experimental data obtained from shadowgraph and PDA. It is revealed that DIH is particularly suitable to provide spatially-resolved, 3D measurements of impinging jet sprays that are not particularly dense.

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