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ABSTRACT:

Flow field analysis of three in-line turbulent confined impingement jets onto a corrugated target surface

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In this work, two-dimensional time-resolved particle image velocimetry (TR-PIV) measurements are carried out to study the turbulent flow field of three confined in-line impingement jets onto a corrugated target surface with complete crossflow condition. A comprehensive parametric study is carried out for values of the jets' exit Reynolds number of Re = 3000 and 5000, jets'-to-surface target distances of (H/D = 3,5), and two values of the phase angle (φ) defined as the relative position of the corrugations with respect to the jet nozzles. For φ = 0° and φ = 180°, the center locations of the jet nozzles coincide with the upper and lower undulation of the corrugated target surface, respectively. Flow measurements in several spanwise planes of the impingement test section are acquired to assess the role of the complete crossflow condition on the characteristic frequencies of the oscillating jets. Flow visualization images showing ensemble-averaged and instantaneous flow distributions and turbulent characteristics are presented. The snapshot proper orthogonal decomposition technique (POD) has been applied to extract the dominant vortical structures and to quantify their relative and cumulative energy contributions to the total kinetic energy fluctuation.