

Abstract Submitted
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Advances of Fluid-Structure Interaction Measurements by Multi-Pulse Particle Image Velocimeter/Accelerometer¹ LIUYANG DING, RONALD ADRIAN, Arizona State University, SIVARAM GOGINENI, Spectral Energies, LLC — Multi-pulse particle image velocimeter/accelerometer (PIV/A) is recently developed to improve the performance of conventional PIV and expand the application area. A multi-pulse system consisting of four independent lasers and a high-speed CMOS camera is used for fluid-structure interaction measurements. The test section is an oscillating cylinder (Plexiglas) immersed in refractive-index-matching (RIM) solution and supported by two elastic rods. The unsteady flow field with moving cylinder is imaged at a frequency of 16 sets per cycle, with each set containing four fast consecutive frames. The cylinder motion is tracked by image segmentation technique. Fluid instantaneous and phase averaged velocity and acceleration fields are measured by triple- and quadruple-pulse PIV/A, and their results are compared. Furthermore, the fluid force acting on the cylinder is evaluated using multi-pulse PIV/A data with control volume approach. The rod tip deflection is then calculated by Euler-Bernoulli beam theory and the force measurements, and compared with the ground truth showing good measurement accuracy. The simultaneous velocity, acceleration and force measurements provide a great way for understanding the fluid-structure interaction.

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Liuyang Ding
Arizona State University

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