

Abstract Submitted
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4-Frame Particle Tracking Based on PIV to Study Inertial Particle Relative Motion in Isotropic Turbulence¹ LUJIE CAO, Department of Mechatronic, Ocean University of China, Qingdao 266003, China, ZHONGWANG DOU, ZACHARY PECENAK, FAN YANG, ZACH LIANG, HUI MENG, Department of Mechanical & Aerospace Engineering, State University of New York at Buffalo, Buffalo, NY 14260 — The statistics of particle pair relative velocity is a critical parameter in particle collision models. Experimental measurements are required to quantify the dependence of inertial particle relative velocity on turbulence and particle parameters. Our aim is to develop a technique that can directly measure the dynamics of inertial particles relative velocity statistics, in high Re number, lab-generated isotropic turbulence. The technique is based on 4-frame particle tracking using two sets of regular PIV systems, each recording a pair of correlated particle images, with additional synchronization controlling the temporal relationship between two PIV sets. To ensure spatial correlation between coordinates in images, we (1) use perpendicularly polarized laser illumination to label particle scattering with corresponding PIV recording, (2) make the two illumination laser sheets overlap at the test field, (3) arrange two PIV cameras orthogonally after a polarizing beam splitter to record the particle field. This allows us to capture 4 consecutive frames of particle images with a certain spatial shift. PTV algorithm is applied to further extract particle trajectories, from which we directly measure particle position and absolute velocity and further deduce particle relative velocity.

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