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Numerical Evaluations of a Multiple 3D Particle Tracking Velocimetry System for Indoor Air Flow Study

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ABSTRACT

High-quality data obtained from three-dimensional Particle Tracking Velocimetry (3D PTV) is pivotal for indoor environment engineering when designing ventilation strategies or monitoring airborne pollutants dispersion in inhabited spaces. A new method is proposed to link multiple 3D PTV systems, positioned side by side so that the entire measuring volume can be covered. An algorithm is developed to establish a link between the particles' trajectories calculated by each 3D PTV system. To evaluate the validity and robustness of the multi-PTV algorithm, synthetic particles were created, which follow different motions implemented in Matlab, including two analytical solutions for incompressible Navier-Stokes equations, namely Kovaszny and Beltrami flows, as well as a linear motion. Two different tracking algorithms were used to obtain 3D particle positions. The numerical results reveal that the proposed method is capable of connecting adjacent multiple PTV systems with reasonable accuracy and therefore can be considered as a promising method for indoor airflow measurements.

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