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3D flow effects on measuring turbulence statistics using 2D PIV[1]

HOONSANG LEE, WONTAE HWANG, Department of Mechanical Aerospace Engineering Seoul National University — Homogeneous & isotropic turbulence (HIT) with no mean flow is the simplest type of turbulent flow which can be used to study various phenomena. Although HIT is inherently three dimensional in nature, various turbulence statistics can be measured with 2D PIV utilizing various assumptions. In this study, the loss of tracer particle pairs due to out-of-plane motion, and the effect it has on statistics such as turbulence kinetic energy, dissipation rate, and velocity correlations is investigated. Synthetic PIV images created from HIT direct numerical simulation (DNS) data are utilized to quantify this effect. We estimate the out-of-plane error by adjusting parameters such as PIV time interval, interrogation window size, and particle size. This information can be utilized to optimize experimental parameters when examining 3D turbulence via 2D PIV.

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