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Analysis of velocity gradient tensor in a turbulent planar jet with triple decomposition MASATO HAYASHI, TOMOAKI WATANABE, KOJI NAGATA, Nagoya Univ — Local turbulent motions are investigated with a triple decomposition, which decomposes a velocity gradient tensor into three components representing an irrotational straining motion, a rotating motion, and a shearing motion. Analysis based on the triple decomposition is applied to direct numerical simulation data of a temporally evolving incompressible planar jet. Averages of the norm of the decomposed tensors show that the shearing motion is dominant in the turbulent region, while fluid motions outside the jet comprise solely of the irrotational straining motion. Internal shear layers are detected with local maxima of the magnitude of the vorticity vector associated with the shearing motion. An averaged flow pattern around the shear layers shows that velocity rapidly changes across the shear layers, whose thickness is about 10 times the Kolmogorov scale. Moreover, a biaxial strain acts on the shear layers, where the direction of compression is perpendicular to the shear layers. It is confirmed that the Burgers vortex layer predicts well the relation between the shear layer thickness and the intensity of the biaxial strain. A comparison between the turbulent planar jet and homogeneous isotropic turbulence confirms that the velocity jump and thickness of the shear layer scale with Kolmogorov velocity and length scales in both flows.

Masato Hayashi
Nagoya Univ

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