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Investigation of turbulent energy transport by applying POD-LSE complementary method[1] OSAMU TERASHIMA, YASUHIKO SAKAI, KOUJI NAGATA, YASUMASA ITO, Nagoya University — Turbulent energy transport mechanism involving large-scale coherent vortex structures in the self-similarity region of a plane turbulent jet is experimentally investigated. First, a simultaneous multipoint measurement of two velocity components and pressure is performed by using several combined probes consisting of a pressure probe and an X-type hot-wire probe. Then, proper orthogonal decomposition (POD) is applied to both velocity and pressure fields to determine the coherent vortex structure in the jet. Further, a complementary technique of POD and linear stochastic estimation (LSE) is used to reconstruct the spatiotemporal velocity and pressure field of the dominant POD mode. As a result of reconstruction, the coherent structure with counter-rotating vortices staggering to the jet centerline is extracted and it contains approximately 42% of the total turbulent energy. Finally, the turbulent energy transport caused by the large scale coherent vortex structure is evaluated by using the reconstructed velocity and pressure fields. The results show that the production and pressure diffusion of the turbulent energy in the jet are mainly caused by this coherent vortex structure.

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