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Dynamic Mode Decomposition of Jet in Channel Crossflow[1]

ZHAO WU, DOMINIQUE LAURENCE, Univ of Manchester — In this paper, the authors present a comparative analysis of Koopman modes computed from snapshots of direct numerical simulations of a jet in channel crossflow (channel flow Re number =3333, jet-to-crossflow velocity ratio =1/6). The flow is complex due to interactions between the jet and the cross-flow, and contains geometry-dependent large-scale coherent structures; thus, the Koopman mode analysis provides a powerful tool for studying the spatial and spectral information of the flow. The Koopman modes are approximated by the DMD modes restricted to Krylov subspace, and the Koopman modes isolate structures associated with single frequency only. In this work, we address issues related to the physical interpretation of the DMD modes. The results show that the computed Koopman modes identify the relevant frequencies and the corresponding three-dimensional flow structures automatically. We present the selected DMD modes, which show big differences in the spatial structures and frequency. The shear layer vortices are separated from the horseshoe vortex. These modes have large amplitudes among all modes obtained.

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