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Network-based identification of influential structures to modify turbulent flows[1] MURALIKRISHNAN GOPALAKRISHNAN MEENA, KUNIHIKO TAIRA, University of California, Los Angeles — The nonlinear interactions among vortical structures in turbulence make their characterization and control a challenge. We use network theory to formulate and characterize the web of interactions among vortical elements in two- and three-dimensional decaying isotropic turbulence. The nodes of these networks correspond to vortical elements in the flow field and the connections among them are weighted by the induced velocity. Network-based community detection algorithm is used to identify network connector (inter-community) and peripheral (intra-community) structures that resemble shear-layer and vortex-core type structures, respectively. We assess the influence of these structures to the neighboring vortical structures by performing DNS with added impulse perturbations to the identified network-based structures. We compare our findings with those from traditional forms of structure identification and observe enhanced turbulent mixing with the present approach. We discuss the implications of the present network-based technique for active flow control.

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