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Tensor-based Lagrangian time correlations in DNS of isotropic turbulence[1] HUIDAN YU, Johns Hopkins University, CHARLES MENEVEAU, Department of Mechanical Engineering and Institute for Data Intensive Engineering and Science, Johns Hopkins University — We study Lagrangian statistics of dynamically important tensors, such as velocity- gradient tensor, together with its symmetric and antisymmetric parts, through fluid particle tracking. The data, a 1024^4 space-time DNS of forced isotropic turbulence, are accessed using the web-services of the JHU public database (http://turbulence.pha.jhu.edu). A Tensor-based time-correlation function is defined by the tensor product between variables at different times along the Lagrangian trajectory. Analyses in the literature had shown slightly longer correlation times for the square rotation rate as compared to the square strain-rate magnitude. However, here we show that the difference is much larger when considering the dynamically more relevant tensor-based correlation function. The question whether these trends are due mostly to vortical coherent structures (worms) is addressed using conditional averaging. Even with the exclusion of worms, rotation-rate remains significantly more correlated over time than the strain-rate. The analysis is done for the pressure Hessian tensor and significant differences are obtained for its trace and deviatoric parts.

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