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Relationships between development/decay of a vortex and its topology in different flow scales in an isotropic homogeneous turbulence[1]
KEISUKE YAMAMOTO, Division of Mechanical Engineering, Graduate School of Engineering, Aichi Institute of Technology, KATSUYUKI NAKAYAMA, Department of Mechanical Engineering, Aichi Institute of Technology — Development or decay of a vortex in terms of the local flow topology has been shown to be highly correlated with its topological feature, i.e., vortical flow symmetry (skewness), in an isotropic homogeneous turbulence [K. Nakayama, Phys. Rev. Fluids (2017)]. Since a turbulent flow might include vortices in multi-scales, the present study investigates the characteristics of this relationships between the development or decay of a vortex and the vortical flow symmetry in several scales in an isotropic homogeneous turbulence in low Reynols number. Swirlity is a physical quantity of an intensity of swirling in terms of the geometrical average of the azimuthal flow, and represents the behavior of the the development or decay of a vortex in this study. Flow scales are decomposed into three scales specified by the Fourier coefficients of the velocity applying the band-pass filter. The analysis shows that vortices in the different scales have a universal feature that the time derivative of swirlity and that of the symmetry have high correlation. Especially they have more stronger correlation at their birth and extinction.

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