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Identification of key flow for vortex generation in terms of local flow geometry[1] KATSUYUKI NAKAYAMA[2], Aichi Institute of Technology — The flow transition into a vortical flow in terms of the invariant local geometry (topology) specified by the velocity gradient tensor is analysed with the swirlity that is a physical quantity to represent the unidirectionality and intensity of the azimuthal flow extracted from the local flow. The velocity gradient tensor is represented in a specific coordinate system where these components are given by invariant quantities and related to the flow topology. While the swirlity specifies the transition process into a vortical flow and predicts its generation, the tensor components are traced. Then the key flow that contributes the vortex generation is identified as an invariant shear (or strain) flow, where its effect is evaluated. This analysis of the flow transition with statistical analysis in an isotropic homogeneous turbulence in a low Reynolds number shows that the key flow is the shear flow in the predicted swirl plane (after vortex transition) orthogonal to one eigenvector. This particular characteristic is similar irrespective of decomposed flow scales in this turbulence (using the band pass filter of the Fourier coefficient of the velocity), with the feature of the swirlity.

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