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On the Structure Orientation in Rotating and Sheared Homogeneous Turbulence[1] JOYLENE C. AGUIRRE, ADAM F. MOREAU, FRANK G. JACOBITZ, University of San Diego — The results of direct numerical simulations are used to study the effect of rotation on the orientation of structures and the evolution of the turbulent kinetic energy in homogeneous sheared turbulence. Shear flows without rotation, with moderate rotation, and with strong rotation are considered and the rotation axis is either parallel or anti-parallel to the mean flow vorticity. In the case of moderate rotation, an anti-parallel configuration increases the growth rate of the turbulent kinetic energy, while a parallel configuration decreases the growth rate as compared to the flow without rotation. The orientation of turbulent structures present in the flows are characterized using the three-dimensional, two-point autocorrelation coefficient of velocity magnitude and vorticity magnitude. An ellipsoid is fitted to the surface defined by a constant autocorrelation coefficient value and the major and minor axes are used to determine the inclination angle of flow structures in the plane of shear. It was found that the inclination angle assumes a maximum value for the anti-parallel configuration with moderate rotation. Again, the inclination angle for the parallel configuration with moderate rotation is reduced as compared to the case without rotation. The smallest inclination angles are found for the strongly rotating cases. Hence, the inclination angle is directly related to the growth rate of the turbulent kinetic energy.

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