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On the stability of homogeneous three-dimensional turbulent flows ANANDA MISHRA, SHARATH GIRIMAJI, Texas A&M University — Flows experiencing spatially uniform deformation rate, appellated as homogeneous flows, are the most elementary cases to exhibit hydrodynamic instabilities. While the stability characteristics of homogeneous flows subject to planar strain and rotation are well-established, those of three-dimensional flows are not. We address the stability characteristics of general incompressible flows undergoing three-dimensional streamline convergence, divergence and swirl. Two of the salient findings are:(i) flow stability is completely contingent upon the third invariant of the background velocity gradient tensor - flows with a positive third invariant are stable while those with a negative value are unstable; and, (ii) with the sole exception of two-dimensional elliptic flows, inertial effects are destabilizing and pressure effects are stabilizing.

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