Objective identification of kinematic instabilities in shear flows[1]

BJOERN KLOSE, San Diego State University, MATTIA SERRA, Harvard University, GUSTAAF JACOBS, San Diego State University
— A kinematic approach for the identification of flow instabilities in the Lagrangian frame is presented. We define the instability as the increased folding, or wrinkling, of lines of fluid particles which is described by the curvature change over a finite time interval. Because the curvature is frame invariant and independent of its parametrization, the identification is objective and applicable to flows of general complexity. No assumptions or knowledge of the averaged solution of the flow field are required, as the identification only depends on the kinematics of the material lines. Examples of a temporally developing jet flow, a separated shear flow over an airfoil at moderate Reynolds number, and the onset of a wake instability behind a circular cylinder are presented.

Bjoern Klose
San Diego State Univ

Date submitted: 03 Aug 2020   Electronic form version 1.4