On the non-local geometry of turbulence[1] IVAN BERMEJO-MORENO, D.I. PULLIN, California Institute of Technology, KIYOSI HORIUTI, Tokyo Institute of Technology — A multi-scale methodology for the study of the non-local geometry of structures in turbulence is applied to a passive-scalar field and the square of the vorticity field of a 5123 periodic cube DNS of homogeneous isotropic turbulence. Results of its application to the vorticity field of a set of DNS with identical initial conditions and increasing grid resolutions $(256, 512, 10243,$ with $k_{max}\eta \approx 1,2,4)$ are also discussed. The methodology consists of three main steps: extraction, characterization and classification, starting from a 3D scalar field. Extraction is done via the curvelet transform (allowing a multi-scale decomposition), followed by isosurfacing of the set of scalar fields obtained by filtering in curvelet space. Characterization is based on the area-based probability density function of two differential-geometry properties, shape index and curvedness, complemented with global invariants of the surface, thus defining its signature. Classification uses a feature space of parameters obtained from the signature of each structure,where clustering techniques are applied searching for groups of structures with common geometry.

Dale Pullin
California Institute of Technology

Date submitted: 03 Aug 2007   Electronic form version 1.4