Anatomy of a turbulent spot

Brian Cantwell, Donald Coles, and Paul Dimotakis

California Institute of Technology, Pasadena, California 91109

Measurements have been made in the plane of symmetry of a turbulent spot to study the issue of entrainment. The mean flow is assumed to be similar in coordinates $(x/t, y/t)$, and laser Doppler velocimeter data at several stations are used to determine the effective origin in x and t and to establish particle trajectories with respect to the stationary interface. Entrainment occurs over most of the rear interface and also close to the wall at the front of the spot. Flow visualization has also been used to obtain additional information about entrainment and sublayer structure. Pictures of the underside of spots, wedges, and boundary layers were taken through a glass wall, using a very heavy concentration of aluminum flakes, so that only motions occurring for y^+ less than about 30 were visible. Sublayer streaks have essentially the same streaky, knotted appearance in all three types of flow. Optical correlations confirm the value $\lambda^+ \sim 100$. An attempt has been made to estimate the strength of sublayer streaks as streamwise vortices, assuming that the streaks are a manifestation of local Taylor–Görtler instability. The results account for many of the phenomena actually observed in the sublayer.

Drag reducing polymer in helicoidal flow

Leslie S. G. Kovasznay and Jing Tzong Kuo[a]

The Johns Hopkins University, Baltimore, Maryland 21218

High polymer additives in low concentration have a rather important effect in turbulent flows, but when using the same concentration in a variety of laminar flows, in general, they have only very small effects, only of the order of the viscosity change. In order to see a flow configuration where a small amount of additive (e.g., 10 to 100 ppm) would cause a large effect comparable to that in the turbulent case, a novel configuration was explored. A screw pump, consisting of a smooth hollow cylinder and inside it a concentrically placed smooth screw with a gap comparable to the dimensions of the screw thread was constructed and the flow variables were measured. The pressure head developed by the screw pump was found to be strongly dependent on the presence of additives (by a factor of 2–3).

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[a] Present address: Thayer School of Engineering, Dartmouth College, Hanover, N. H. 03755.

Triggered transition in the pipe flow of dilute solutions of random-coiling macromolecules

P. S. Virk and M. Ohara

Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139

Laminar-to-turbulent transition was studied experimentally in the flow of dilute, distilled water solutions of two polyethyleneoxide polymers through three pipes, each 200 diam long and equipped with a "trigger" orifice, of i.d. half the pipe i.d., to provide a strong inlet disturbance. Polymer molecular weights, 0.7×10^6 and 5.0×10^6, and pipe sizes, 0.292, 0.457, 0.945 cm i.d., were chosen to cause transition from the laminar regime (L) into each of three turbulent regimes associated with drag reduction,[1] namely, Newtonian (N), polymeric (P), and maximum drag reduction (M). The corresponding three types of laminar-to-turbulent transitions observed, designated $L\rightarrow N$, $L\rightarrow P$, $L\rightarrow M$, had the following characteristics: (1) $L\rightarrow N$. In this case the transition occurred from laminar flow into a turbulent regime wherein the polymer solutions did not cause drag reduction, and the transition process appeared to be the same as in the usual Newtonian case.[2,3] (2) $L\rightarrow P$. In this case the polymer solutions exhibited drag reduction at the lowest fully turbulent flow rates. The critical Reynolds number, below which turbulent

