

PHYSICAL MATHEMATICS SEMINAR

Edge of Chaos and the Turbulence Transition in Pipe Flow - How does Flow in a Pipe become Turbulent?

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ABSTRACT:

Pipe flow is a prominent example among the shear flows that undergo transition to turbulence without mediation by a linear instability of the laminar profile. Experiments on pipe flow, as well as plane Couette flow, show that triggering turbulence depends sensitively on initial conditions, and that turbulence is not persistent, i.e., it can decay again, if the observation time is long enough. These features can consistently be explained on the assumption that the turbulent state corresponds to a chaotic saddle in state space coexisting with the laminar fixed point. Regions of laminar and turbulent dynamics in the system's state space are separated by the 'edge of chaos' which extends the concept of basin boundaries to situations with transient turbulence. Using an iterated bracketing technique we can numerically trace the dynamics in this edge of chaos and determine the invariant relative attractors termed 'edge states'. The significance of these states lies in their governing role for triggering turbulence as well as for relaminarization.

TUESDAY, MARCH 31, 2009

2:30 PM

Building 2, Room 105

*Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)*



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