FM13L_10313

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Travelling Waves and Transition to Turbulence in Pipe Flow

Bruno Eckhardt, Holger Faisst

Fachbereich Physik, Philipps Universitat Marburg, Germany

At critical Reynolds numbers as low as 1250 3-d travelling wave solutions have been found in pipe flow. The waves are dominated by pairs of downstream vortices and associated streaks. The wave with the lowest critical Reynolds number has 3 pairs, but others with 2 to 5 pairs have been found as well. The states are unstable, but can be detected in direct numerical simulations and seem to be responsible for the formatin of a chaotic saddle that dominates the transition to turbulence. In particular, the life time of perturbations show strong fluctuations, and can well be described by an exponential distribution, in agreement with the chaotic saddle picture. The median life time increases rapidly and becomes inaccessibly large for Re about 2250.

View the extended summary