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Sequences of Bifurcations in Fluid Flows and Coherent Structures in Trubulence

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Summary

Most systems of fluid flow find their simplest realisation in a geometrical configuration that is homogeneous in two spatial dimensions and in time. Fluid systems of this kind often exhibit sequences of bifurcations through which a stepwise evolution occurs from simple to complex structures of flow. While the basic primary state of flow reflects all symmetries of the system, the secondary state generically assumes the form of roll like motion. Only tertiary and higher states of motion exhibit characteristic properties of the system and of regions of the parameter space. Some of the characteristic structures persist as coherent structures far into the turbulent regime. Examples from the plane Couette flow system and from thermal convection are used to illustrate general aspects of the problem.