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The primary instability of viscoelastic flow through a curvilinear square–duct channel is a Hopf bifurcation CHRISTIAN WAGNER, Saarland University — Curvilinear channels are of specific interest, because they might open the way for mixing application in microfluidic devices and most of the existing studies on curvilinear channels have investigated the large Weissenber number Wi regime where the flow is rather turbulent. Less is known on the type of the primary instability. Recently it was shown both experimentally and numerically that the Pakdel-McKinley-criterion is indeed fulfilled in curvilinear channels, i.e. that the onset of linear instability scales with the square root of the radius of curvature. Recent numerical work predict that the primary instability of the flow should be an oscillatory one. It is one goal of our current work to supply experimental evidences for this prediction. We characterize the bifurcation scenario of the primary instability of viscoleastic flow in a curvilinear channel. We find that the instability sets in first at the end of the channel and the primary instability of the laminar flow is oscillatory, i.e. a Hopf bifurcation. With increasing flow velocity the characteristic period of the instability starts to change slowly in time in an irregular manner but it is always comparable to the polymer relaxation. At higher Weissenberg numbers the flow becomes finally featureless and viscoelastic turbulence sets in.

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