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Transient growth and its consequences in rotating channel flow¹ SHARATH JOSE, Tata Institute of Fundamental Research, Centre for Interdisciplinary Sciences, VISHNU PRASAD, Shell Technology Center Bangalore, BENOîT PIER, LMFA (CNRS-Université de Lyon), France, RAMA GOVINDARAJAN, Tata Institute of Fundamental Research, Centre for Interdisciplinary Sciences — We know that pressure-driven flow through a channel, which is being rotated about its spanwise coordinate, is unstable for a range of rotation numbers Ro. The critical Reynolds number is very sensitive to the rotation rate. We present here nonmodal stability characteristics of the system in the parameter regime where exponential instabilities do not exist. We show that transient growth is markedly different at low and high Ro, with high growth rates and asymmetric streamwise structures at low Ro and spanwise structures created by the far weaker Orr mechanism in operation at high Ro. The latter is a demonstration of the Taylor-Proudman theorem. In the nonlinear regime, except when the rotation rate is very high, chaotic flows of varying strength are obtained. At high Ro weak structures confined to one side of the channel give way to a completely laminar profile.

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