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Stability of two-dimensional collapsible-channel flow to inviscid perturbations TIMOTHY PEDLEY, University of Cambridge, RAMESH KUDENATTI, Bangalore University — We consider the linear stability of two-dimensional inviscid but vortical flow in a rigid, parallel-sided channel, of which part of one wall has been replaced by a flexible membrane under longitudinal tension T. Far upstream the flow is parallel Poiseuille flow; the width of the channel is a and the length of the membrane is λa, where $\lambda \gg 1$. Steady flow at high Reynolds number Re was studied using interactive boundary-layer theory by Guneratne & Pedley (J. Fluid Mech. **569**, 151-184, 2006) for various values of the pressure difference P_e across the membrane at its upstream end. Here we study small-amplitude, unsteady perturbations to the trivial steady solution for $P_e = 0$. An unexpected finding is that the flow is always unstable, with a growth rate that increases with T. In other words, the stability problem is ill-posed. However, when the pressure difference is held fixed (= 0) at the downstream end of the membrane, the problem is well-posed and all solutions are stable. The physical mechanisms underlying these findings are explored; the crucial factor in the fluid dynamics is the vorticity gradient across the incoming Poiseuille flow. Similar results are found for the viscous problem at high Re.

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