**A dynamical instability due to fluid-wall coupling lowers the transition Reynolds number in the flow through a flexible tube.**

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The instability in the flow through soft tubes is studied experimentally, in order to examine whether the interaction between the flow and the soft wall could reduce the transition Reynolds number. In the experiments, tubular bores of diameter about 1 mm are cast in polymer gels made of polydimethylsiloxane (PDMS), and shear modulus of these gels is varied in the range $10 - 500$kPa by varying the catalyst concentration. The flow is driven by a pressure difference across the tube, and the friction factor $f$ is measured as a function of the Reynolds number $Re$. Experiments show that the laminar flow becomes unstable, and there is a transition to a more complicated flow profile, for Reynolds numbers as low as 500 for the softest gels used here. The nature of the $f - Re$ curves is also qualitatively different from that in the flow past rigid tubes; in contrast to the discontinuous increase in the friction factor at transition in a rigid tube, it is found that there is a continuous increase in the friction factor from the laminar value of $(16/Re)$ in a flexible tube. The onset of transition is also detected by a dye-stream method, where a stream of dye is injected into the center of the tube. The transition Reynolds number is significantly lower than that predicted theoretically for the parabolic flow in a cylindrical tube. In order to resolve the discrepancy, the flow modification due to the channel deformation is determined, and the transition Reynolds number for the non-parabolic flow is determined using the locally parallel approximation. For the deformed tube, transition is first predicted in the downstream converging section, and the transition Reynolds number is in agreement with experiments.

## References

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