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Transitions to different kinds of turbulence in a channel with soft walls.[1] VISWANATHAN KUMARAN, SAGAR SRINIVAS, Indian Inst of Science — The flow in a soft-walled channel undergoes a transition to turbulence at a Reynolds number which is a fraction of the transition Reynolds number of 1200 for a rigid channel, due to a dynamical instability caused by a fluid-wall coupling. The turbulent flow after transition in a channel with walls made of polyacrylamide gel is experimentally characterised. There are two other types of turbulence observed in sequence as the Reynolds number is increased. The first is the soft-wall turbulence, which involves wall oscillations primarily tangential to the surface, coupled with large fluid velocity fluctuations. The fluid velocity fluctuations share many of the characteristics of those in the flow past a rigid surface, but there are significant differences; the velocity fluctuations do not seem to decay to zero at the wall, and the mechanism of turbulence production seems to be different. As the Reynolds number is increased, there is a second wall-flutter transition which involves solid displacement perpendicular to the wall, and takes place only if the wall is unrestrained. The two transitions take place in sequence from a laminar flow when the soft-wall transition Reynolds number is less than 1200, and from a turbulent flow if the soft-wall transition Reynolds number exceeds 1200.

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