

Abstract Submitted
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Open-loop control for complete relaminarisation of turbulent pipe flow JAKOB KHENEN, DAVIDE SCARSELLI, BJRN HOF, IST Austria — We show that a simple and predetermined perturbation is able to annihilate turbulent pipe flow by disrupting the sustaining mechanism of turbulence at the wall, causing complete relaminarisation further downstream. The annihilation of turbulence is effected by a steady, open-loop manipulation of the streamwise velocity component only. We control and perturb the flow such that the streamwise velocity profile becomes more flat, i.e. we increase the streamwise velocity close to the wall and decrease the velocity in the center of the pipe. We will present several different control schemes from laboratory experiments which achieve the required perturbation of the flow for total relaminarisation up to Reynolds numbers of 40 000. We will present measurements with high-speed particle image velocimetry, measurements of the pressure drop and videos of the development of the flow during relaminarisation. Transient growth, a linear amplification mechanism measuring the efficiency of eddies in redistributing shear that quantifies the maximum perturbation energy amplification achievable over a finite time in a linearized framework, is shown to set a clear-cut threshold below which turbulence is impeded in its formation and thus permanently annihilated.

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