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Passive control of the flow in a symmetric channel with a sudden expansion based on linear stability analysis ANDREA FANI, SIMONE CAMARRI, MARIA-VITTORIA SALVETTI, University of Pisa — In the present work we investigate the stability properties of the flow in a 2D-plane channel with a symmetric sudden expansion, which is a possible schematization of a plane diffuser. The laminar flow in 2D diffusers may produce either symmetric or nonsymmetric steady solutions, depending on the value of the Reynolds number Re as compared with some critical value Re_c . The stability properties of the flow are studied in the context of linear theory, characterizing the sensitivity of the instability to both a structural perturbation of the linearized flow equations and a perturbation of the base flow. The information provided by the two kinds of analysis is used to propose a passive flow control strategy, obtained by the introduction of a small cylinder in the channel, aimed at stabilizing the symmetric solution at $Re > Re_c$. The effectiveness of this control strategy in the nonlinear case is investigated, and ultimately verified by numerical simulations of the flow in which a real control cylinder is introduced. The robustness of the control is also tested by numerical simulations in which the position of the cylinder is slightly changed with respect to the optimal one given by the sensitivity analysis.

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