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Multiple local recirculations to reduce flow separation and increase efficiency of diffusers ALESSANDRO MARIOTTI, GUIDO BURESTI, MARIA VITTORIA SALVETTI, DICI, University of Pisa — Boundary layer separation causes a decrease of performance in diffusers. We analyze a passive method for flow control in diffusers, based on the introduction of single and multiple contoured cavities in the walls. The proposed control strategy is investigated through numerical simulations of the flow in plane diffusers having an area ratio of 2 and different divergence angles. The location and geometry of the cavities are numerically optimized to maximize the pressure recovery in the diffuser. In all cases, the introduction of the optimal cavities leads to a strong increase in the pressure recovery and, when present, to a significant reduction of the main flow separation zone. The flow separates at the cavity upstream edge and rapidly reattaches, forming a small closed recirculation region within and immediately downstream of the cavities. These recirculation zones lead to both a favorable local modification of the virtual shape of the diffuser and to a reduction of the dissipation in the near-wall region due to the relaxation of the no-slip condition. A generic optimization of the diffuser shape is also carried out; if the number of degrees of freedom is large enough, the presence of small local recirculations is again found in the optimized configuration.

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