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Designing smart duct geometries for low frictional losses GERTRAUD DASCHIEL, Institute of Fluid Mechanics, Karlsruhe Institute of Technology, VERONIKA KRIEGER, JOVAN JOVANOVIC, Institute of Fluid Mechanics, University of Erlangen-Nuremberg, BETTINA FROHNAPFEL, Institute of Fluid Mechanics, Karlsruhe Institute of Technology — In turbulent flows through triangular ducts the friction factor is significantly reduced compared to the well-proven Blasius correlation. The passages of reduced friction are detected close to the duct corners in which the flow also shows a strong tendency in the turbulent fluctuations towards the statistical axisymmetric state. Within the present investigation direct numerical simulations of turbulent flows through non-circular ducts are carried out. The duct shapes are designed with the goal to reduce frictional losses in the turbulent state by forcing turbulent fluctuations towards statistical axisymmetry in a wide part of the flow domain. In this respect, the influence of the corners' opening angle and the surface curvature are investigated. Interestingly, the state of statistical axisymmetry is also reported to lead to a stabilization of disturbances in laminar flows and consequently delay the breakdown to turbulence. From this finding it might be expected that duct geometries leading to this particular statistical properties of the turbulent fluctuations also can have beneficial effects in the delay of the laminar to turbulent transition process. First numerical experiments that tackle this point will be presented.

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