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Conjugate heat transfer in turbulent flows inside rough ducts UMBERTO CIRI, KENAN WRIGHT, STEFANO LEONARDI, The University of Texas at Dallas — Convective cooling inside ducts is a problem with significant practical importance. For instance, blades in gas turbine engines are machined with internal channels, where fluid spilled from the compressor cools the blades, externally impinged by hot fluid after combustion. Enhancement of the heat transfer coefficient for the flow inside the duct allows increasing the blade operative temperature, which improves the overall engine efficiency. Placing turbulators, such as V-shaped ribs, on the duct internal walls is a common technique to enhance heat transfer. The rough elements promote fluid mixing by increasing the turbulence intensity, leading to a heat exchange enhancement. This work aims to investigate the sensitivity of the thermal performance to the V-shaped ribs design parameters, such as the element pitch-to-height ratio. We will study the modifications induced by the ribs on turbulence, secondary motion and the impact on heat transfer coefficient and pressure drop. The study is conducted performing direct numerical simulations of conjugate heat transfer for turbulent flows inside ducts with rectangular V-shaped ribs on the wall. The duct walls and ribs are treated with the immersed boundary method, which allows us to efficiently resolve the conjugate heat transfer problem.

Umberto Ciri
The University of Texas at Dallas

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