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Turbulent Channel Flow With Λ Shape Turbulators on One Wall

JAIME TORO, BENJAMIN CRUZ, STEFANO LEONARDI, University of Puerto Rico at Mayaguez — tudy of turbulent heat or mass transport is of special interest in engineering, especially for heat exchangers. For instance, roughness elements (turbulators) are usually placed on the walls of the internal channels of a turbine blade to enhance the heat transfer. In the present paper, DNSs are carried out for passive heat transport in a turbulent channel flow with Λ shape square ribs for w/k = 1, 3, 7, 15 (w being the pitch, k the height of the ribs turbulators. The angle of inclination of the lambda shape turbulators is 45 degrees. Numerical results show that Λ shape square ribs are more efficient than square ribs in maximizing the heat transfer. The configuration with w/k=3 presents the largest heat flux. The increase in the heat transfer is due to a secondary motion which is generated by the Λ shape turbulators. Two counter rotating vortices above the square ribs transport the heat out of the wall into the center of the channel. The distribution of the heat flux coefficient is not uniform in the channel and leads to temperature gradients at the wall. The total drag of the Λ shape turbulators is larger than that over a smooth wall due to an increase of form drag.

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