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LES-SIMULATION OF HEAT TRANSFER IN A TURBULENT PIPE

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Study of turbulent pipe flows is extremely important because of its wide range of applications. In the past decades, many fundamental theoretical and experimental studies on wall-bounded flows have been performed: in the pipe, flat channel and boundary layer flow geometries. However, the internal fluid dynamics in these regions still far from being understood. Numerical simulation offers an opportunity to get detailed information on the flow structure, which is difficult to obtain experimentally.
In this paper, the numerical simulation of turbulent heat transfer in a circular pipe was performed in a wide range of Reynolds numbers using nonparametric MILES-method CABARET on grids with an incomplete resolution of the turbulence spectrum, as well as with the use of the STAR-CCM+ code in a LES-approximation. The calculation results was compared with the DNS calculations by other authors found in literature, as well as with the RANScalculations performed in the STAR-CCM+ code. The simulation showed a satisfactory accuracy in determining average, rms and integral characteristics of the flow, and revealed drawbacks in the existing model relations describing the local properties of turbulence. The authors have proposed a thermal wall function, which might be implement in the RANS-approximations.

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