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Turbulent Heat Transfer in Curved Pipe Flow[1] CHANGWOO KANG, KYUNG-SOO YANG, Inha University, Korea — In the present investigation, turbulent heat transfer in fully-developed curved pipe flow with axially uniform wall heat flux has been numerically studied. The Reynolds numbers under consideration are $Re_\tau = 210$ (DNS) and 1,000 (LES) based on the mean friction velocity and the pipe radius, and the Prandtl number (Pr) is 0.71. For $Re_\tau = 210$, the pipe curvature (κ) was fixed as 1/18.2, whereas three cases of κ (0.01, 0.05, 0.1) were computed in the case of Re_τ =1,000. The mean velocity, turbulent intensities and heat transfer rates obtained from the present calculations are in good agreement with the previous numerical and experimental results. To elucidate the secondary flow structures due to the pipe curvature, the mean quantities and rms fluctuations of the flow and temperature fields are presented on the pipe cross-sections, and compared with those of the straight pipe flow. To study turbulence structures and their influence on turbulent heat transfer, turbulence statistics including but not limited to skewness and flatness of velocity fluctuations, cross-correlation coefficients, an Octant analysis, and turbulence budgets are presented and discussed. Based on our results, we attempt to clarify the effects of Reynolds number and the pipe curvature on turbulent heat transfer.

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