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**Turbulent Heat Transfer in Ribbed Pipe Flow**<sup>1</sup> CHANGWOO KANG, KYUNG-SOO YANG, Inha University — From the view point of heat transfer control, surface roughness is one of the popular ways adopted for enhancing heat transfer in turbulent pipe flow. Such a surface roughness is often modeled with a rib. In the current investigation, Large Eddy Simulation has been performed for turbulent flow in a pipe with periodically-mounted ribs at  $Re_\tau=700$ ,  $Pr=0.71$ , and  $p/k=2, 4$ , and  $8$ . Here,  $p$  and  $k$  represent the pitch and rib height, respectively. The rib height is fixed as one tenth of the pipe radius. The profiles of mean velocity components, mean temperature, root-mean-squares (rms) of temperature fluctuation are presented at the selected streamwise locations. In comparison with the smooth-pipe case at the same  $Re$  and  $Pr$ , the effects of the ribs are clearly identified, leading to overall enhancement of turbulent heat transfer in terms of  $Nu$ . The budget of temperature variance is presented in the form of contours. The results of an Octant analysis are also given to elucidate the dominant events. Our LES results shed light on a complete understanding of the heat-transfer mechanisms in turbulent ribbed-pipe flow which has numerous applications in engineering.

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