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The influence of viscosity stratification on boundary-layer turbulence[1] JIN LEE, KAIST, SEO YOON JUNG, Imperial College London, HYUNG JIN SUNG, KAIST, TAMER A. ZAKI, Imperial College London — Direct numerical simulations of turbulent flows over isothermally-heated walls were performed to investigate the influence of viscosity stratification on boundary-layer turbulence and drag. The adopted model for temperature-dependent viscosity was typical of water. The free-stream temperature was set to 30°C, and two wall temperatures, 70°C and 99°C, were simulated. In the heated flows, the mean shear-rate is enhanced near the wall and reduced in the buffer region, which induces a reduction in turbulence production. On the other hand, the turbulence dissipation is enhanced near the wall, despite the the reduction in fluid viscosity. The higher dissipation is attributed to a decrease in the smallest length scales and near-wall fine-scale motions. The combined effect of the reduced production and enhanced dissipation leads to lower Reynolds shear stresses and, as a result, reduction of the skin-friction coefficient.

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Jin Lee
KAIST

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