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DNS of turbulent flow over longitudinally ridged walls. JONY CASTAGNA, YUFENG YAO, Kingston University — An in-house DNS code has been developed over the years and validations have been carried out on various flow problems, including boundary-layer, plain channel, bump flow, and many other cases. This finite difference code solves full three-dimensional compressible Navier-Stokes equations using high-order (4th-order) for spatial derivatives and multi-stage Runge-Kutta explicit scheme for time advancement. The code parallelization has also been carried out using the latest MPI library and is portable for various HPC platforms. The unique feature of the code is that it applies the entropy splitting concept for improve the numerical stability, which is one of common problem for DNS code requiring extremely longer run time to get the statistically converged results. In this study, the code has been further extended to include the capability of treating the geometry variation in the spanwise direction by using full 3D grid transformation, similar that done by other researchers. As demonstration, we follow an existing DNS study of turbulent flow over longitudinally ridged walls at the Reynolds number (Re_τ) 140, based on the friction velocity, as the first step to validate the new capability of the code. Results from present study have been compared fairly well with available DNS data. In the full version of the paper, detailed analysis will be provided, focusing on three parts: mean propriety, turbulence intensity and turbulent coherent structures.

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