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Direct Numerical Simulations of Turbulent Flow in a Wavy Channel LUO WANG, KOSTAS HOUSIADAS, ANTONY BERIS, University of Delaware — A spectrally preconditioned biconjugate gradient algorithm (Bi-CGSTAB) has been developed that enabled us to perform high accuracy (spectral) efficient Direct Numerical Simulations (DNS) of Newtonian turbulent flow in an undulating channel geometry. The DNS of have been performed in a channel geometry involving a single sinusoidal solid wavy wall with amplitude/half width ratio of 0.1 and a wave length of 2. Two different friction Reynolds numbers have been investigated, Re_τ=160 and 220 corresponding to mean Reynolds numbers (based on the channel half width) 1800 and 2480, respectively. The computational domain used was 10x2x5 along the streamwise, shearwise and spanwise direction respectively, with spectral resolutions ranging from 160x257x64 to 320x385x128. The numerical results compare well against Hudson's measurements (Hudson, Ph.D. Thesis, UIUC 1993). In addition, the DNS results allowed us to investigate in detail various turbulence statistics and the vorticity structure and its influence from the wall undulation.

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