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Reynolds number e?ect on drag control via spanwise wall oscillation in turbulent channel ?ows. XI CHEN, Beihang University, JIE YAO, FAZLE HUSSAIN, Texas Tech — The e?ect of Reynolds number (Re_τ) on drag reduction (DR) by spanwise wall oscillation is studied through direct numerical simulation of incompressible turbulent channel ?ows with Re_τ ranging from 200 to 2000. For the non-dimensional oscillation period $T^+ = 100$ with maximum velocity amplitude $A^+ = 12$, DR decreases from 35.3% at Re_τ =200 to 22.3% at Re_τ =2000. The oscillation frequency ω^+ for maximum DR slightly increases with Re_τ, viz., from ω^+ =0.06 at Re_τ =200 to 0.08 at Re_τ = 2000, with DR_{max} = 23.2%. These results show that DR progressively decreases with increasing Re_τ. Turbulent statistics and coherent structures are examined to explain the degradation of drag control e?ectiveness at high Re_τ. FIK analysis in combination with the spanwise wavenumber spectrum of Reynolds stresses reveals that the decreased DR at higher Re_τ is due to the weakened e?ectiveness in suppressing the near wall large-scale turbulence, whose contribution continuously increases due to the enhanced modulation and penetration e?ect of the large-scale and very large-scale motions. Based on the power-law model and the log-law model, we predict more than 10% drag reduction at very high Reynolds numbers, say, $Re_\tau = 10^5$..

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