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Sources of flexible wall excitation and wall-pressure fluctuation in turbulent channel flow[1] SREEVATSA ANANTHARAMU, KRISHNAN MAHESH, University of Minnesota - Twin Cities — Structural excitation by turbulent flows result in vibration. We present one-way coupled fluid structure interaction simulations of linear elastic and viscoelastic plates for different material and geometric properties excited by wall-pressure fluctuations generated from Direct Numerical Simulation (DNS) of incompressible turbulent channel flow at Re_τ of 180 and 400. Fluid DNS simulation is carried out in a moving frame of reference using the discrete kinetic energy conserving finite volume method of Mahesh et al. (2004) and the solid simulation is performed in stationary frame of reference using the finite element method. The one-way coupled results are analyzed by a novel framework that represents the plate averaged response spectral density as a double integral of the net source wall-normal cross-spectral density computed for both Re_τ using DNS data. The relative magnitude and phase of the cumulative sources for different frequencies is obtained using spectral proper orthogonal decomposition. Similar technique is applied to analyze the wall-pressure fluctuation spectra. The distribution and the properties of the net sources that contribute to the plate averaged response and wall-pressure fluctuation spectra is discussed for both Re_τ.

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