Abstract Submitted
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Classification of forcing conditions in pulsatile turbulent pipe flow using Reynolds shear stress co-spectra[1] ZIJIN CHENG, THOMAS O. JELLY, SIMON J. ILLINGWORTH, IVAN MARUSIC, ANDREW S.H. OOI, The University of Melbourne — The turbulence dynamics of pulsatile pipe flow are investigated using data obtained from direct numerical simulations at a mean friction Reynolds number of 180, 270 and 360. The forcing conditions are achieved by applying a time-harmonic axial pressure gradient. This study directs attention towards the frequency response of single- and two-point turbulence statistics to systematic variations in the forcing frequency. We propose a classification of the applied forcing conditions based on the Reynolds shear stress frequency co-spectra and the applied forcing frequency. We perform simulations based on this classification to extend the physical understanding of the phase dependence of single- and two-point turbulence statistics under high, very-high and ultra-high forcing frequencies, focussed around the frequency response of turbulence dynamics in time (frequency) and space (wavenumber) domains. Results also reveal a decoupling behaviour when the frequency of the forcing is higher than the highest frequency (smallest time-scale) of the energy containing motions in the Reynolds shear stress co-spectra.

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