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Nonlinear Mechanisms in Streamwise Constant Plane Couette Flow DENNICE F. GAYME, California Institute of Technology, BASSAM BAMIEH, University of California, Santa Barbara, BEVERLEY J. MCKEON, JOHN C. DOYLE, California Institute of Technology — The dominance of streamwise constant features was previously used to motivate input-output analysis of a streamwise constant (2D/3C) model of plane Couette flow (Gayme et. al 2011). Periodic spanwise-wall normal (z-y plane) stream functions acted as the input and led to a forced 2D/3C streamwise velocity field qualitatively similar to a fully turbulent spatial field of DNS data, in particular having a spanwise mean consistent with the time-averaged mean turbulent velocity profile. In this work, we further explore the relationship between the nonlinearity in the model and the mechanisms involved in creating the turbulent velocity profile's shape. We combine similar input functions with a weakly nonlinear (perturbation) analysis to determine analytical expressions for the leading terms in the streamwise velocity expansion. Our results provide further evidence of the importance of each of the nonlinear streamwise constant terms in the momentum transfer required to generate the turbulent mean velocity profile.
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