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A "resonant" spanwise perturbation frequency in streamwise-constant Couette flow ISMAIL HAMEDUDDIN, DENNICE GAYME, The Johns Hopkins University — Turbulence in plane Couette flow is dominated by streamwise elongated structures that are approximately spanwise periodic with a preferred spatial frequency. It has been postulated that these approximately streamwise-constant coherent structures develop due to streamwise vortices in the flow. We investigate this idea by considering a streamwise-constant (2D/3C) model of plane Couette flow. We introduce streamwise vortices by imposing spanwise periodic cross-stream perturbations on the flow field and study it's energy amplification under stochastic disturbances. The periodic nature of the resulting equations allows us to cast the system into a convenient, so-called "lifted," form that retains the periodic coefficients in the analysis. We can then efficiently solve for the energy amplification using a perturbation approach on the associated Lyapunov equation. Our results show the existence of a peak or "resonant" spanwise frequency that maximizes the disturbance amplification, suggesting that the 2D/3C equations capture the type of (spanwise frequency) selective mechanism that leads to spanwise periodic structures common in fully developed flows.

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