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Computational Study of Turbulent–Laminar Bands in Couette Flow

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Recent experiments by Prigent and Dauchot have shown that the remarkable spiral turbulence state of Taylor-Couette flow also occurs in plane Couette flow. In both cases, a pattern of alternating turbulent and laminar bands appears at a well-defined Reynolds number. The pattern is tilted with respect to the streamwise (or azimuthal) direction and its wavelength is much larger than the gap; the angle and wavelength depend systematically on Reynolds number. We have numerically simulated these turbulent-laminar patterns for plane Couette flow. In our computational approach, we replace the very large lateral dimensions of the experiment by a narrow and periodically repeating rectangle which is tilted with respect to the streamwise direction. In this way we determine which angles and lengths support turbulent bands.

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