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Direct numerical simulations of Taylor-Couette up to Re=400,000

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Taylor-Couette, the flow between two coaxial, independently rotating cylinders, is simulated up to shear Reynolds numbers of $Re_s \sim 4 \cdot 10^5$, corresponding to frictional Reynolds numbers of $Re_\tau \sim 4000$. The radius ratio is set to $\eta = r_i/r_o = 0.909$, to reduce curvature effects and axially periodic boundary conditions are used. One-point statistics and spectra are calculated. Using these, the flow is divided into boundary layer and bulk. The boundary layer, containing a logarithmic sublayer is found to extend up to a tenth of the gap width from the wall. This log-layer shows comparable one-point statistics and spectra to log-layers in other DNS of channels, i.e. $\kappa \approx 0.4$ and a k^{-1} energy spectra in the streamwise (azimuthal) velocity. Further away from the wall, the flow is modified by the large scale Taylor rolls, and a bulk region appears, with very different behaviour. Finally, the effect of the computational domain size on the flow is quantified, and larger computational boxes are compared to the ones used at high Re.

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