The flow regimes in the short Taylor-Couette configurations with independently rotating cylinders, radius ratio 0.5

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The numerical computations (the 3D DNS method) of the transitional and turbulent flows in the short Taylor-Couette configurations with the independently rotating cylinders, and with the end-walls attached to the faster rotating inner cylinder are considered. In the flow cases with cylinders rotating independently, the numerical investigations are mostly carried out with the assumption of the infinitely long cylinders or with the end-walls attached to the outer cylinder. The flow cases with the end-walls attached to the inner cylinder investigated here, have not been previously considered in detail. Under these boundary conditions a very strong transport of the high-velocity fluid from the area near the inner cylinder occurs. The governing parameters are as follows: aspect ratio Γ=3.95-4.025, radius ratio η=0.5, Reynolds number of the inner cylinder up to Re_{in}=3000. The computations are carried out along 14 lines $Re_{in}=Re_{out}\eta/\alpha$, with $\alpha=\Omega_{out}/\Omega_{in}$ (ratio of angular velocities) from the range α=(-0.5)-(+0.275), which corresponds to rotational numbers R_Ω from 0.0 to -1.069. The results obtained for 14 different values of α made it possible to present the obtained critical Reynolds numbers in the (Re_{out}, Re_{in}) plane, and to analyze them in the light of the experimental data published in literature (obtained for η=0.5 and for η=0.883[1]). The patterns of instantaneous velocity fields in the meridian section, the 3D iso-surfaces of λ_2 and the radial profiles of the statistical parameters (the Reynolds stress tensor components, among others) are compared with those published in literature.[2,3] For the selected flow cases the different thermal boundary conditions are implemented at the end-walls and their influence on the Ekman vortices and the turbulent statistics is studied.

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[1] Andereck et al., *J. Fluid Mech.* **164**, 155 (1986).
[2] Dong, *J. Fluid Mech.* **615**, 371 (2008).
[3] Lopez, Avila, *J. Fluid Mech.* **817**, 21 (2017).

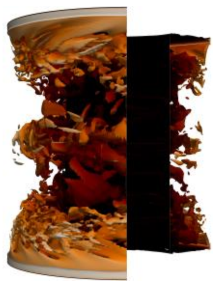

Figure 1: The iso-surfaces of λ_2, Re_1=3000, α=-0.5, η=0.5, Γ=3.95.