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Rotating plane Couette flow at high rotation number A. SURYADI, N. TILLMARK, P.H. ALFREDSSON, Linne FLOW Centre, Stockholm, SWEDEN — Flow structures in the rotating plane Couette flow facility at KTH (described in Tsukahara, et al. *J. Fluid Mech.* vol. **648**) have been studied at high rotation numbers. The test section is 20 mm wide with a length of 1500 mm in the streamwise (x) and 360 mm in the spanwise (z) directions and can be rotated in the spanwise direction up to angular velocities of $\Omega_z \approx 0.6$ rad/s. The flow is characterised by: (1) the Reynolds number Re based on the test section's half-width (h) and half of the velocity difference between the moving walls, (2) the rotation number $\Omega = 2\Omega_z h^2/\nu$. For low rotation numbers the primary instability consists of streamwise-oriented roll cells, but Tsukahara, et al. showed the secondary instability in the form of wavy streamwise oriented roll-cells at $Re = 100$ and $\Omega = 3 - 12$, whereas for higher Ω, the flow structures again stabilize to streamwise-oriented roll cells. Here we find that at even higher Ω in the range $40-70$, a new type of secondary instability develops in the form of counter-rotating helical roll-cells. The structure of this instability, as well as other instabilities, are investigated by flow visualization as well as two-dimensional PIV-measurements in several xz-planes.

Alexandre Suryadi
Linne FLOW Centre, Stockholm, SWEDEN

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