Supplementary Material: OIST-TC: A new experimental setup to study turbulent Taylor–Couette flow

Christian Butcher, Julio M. Barros, Yasuo Higashi, Henry C-H Ng, Tinihau Meuel, Gustavo Gioia, and Pinaki Chakraborty
Okinawa Institute of Science and Technology Graduate University, Onna-son, Okinawa, Japan 904-0495

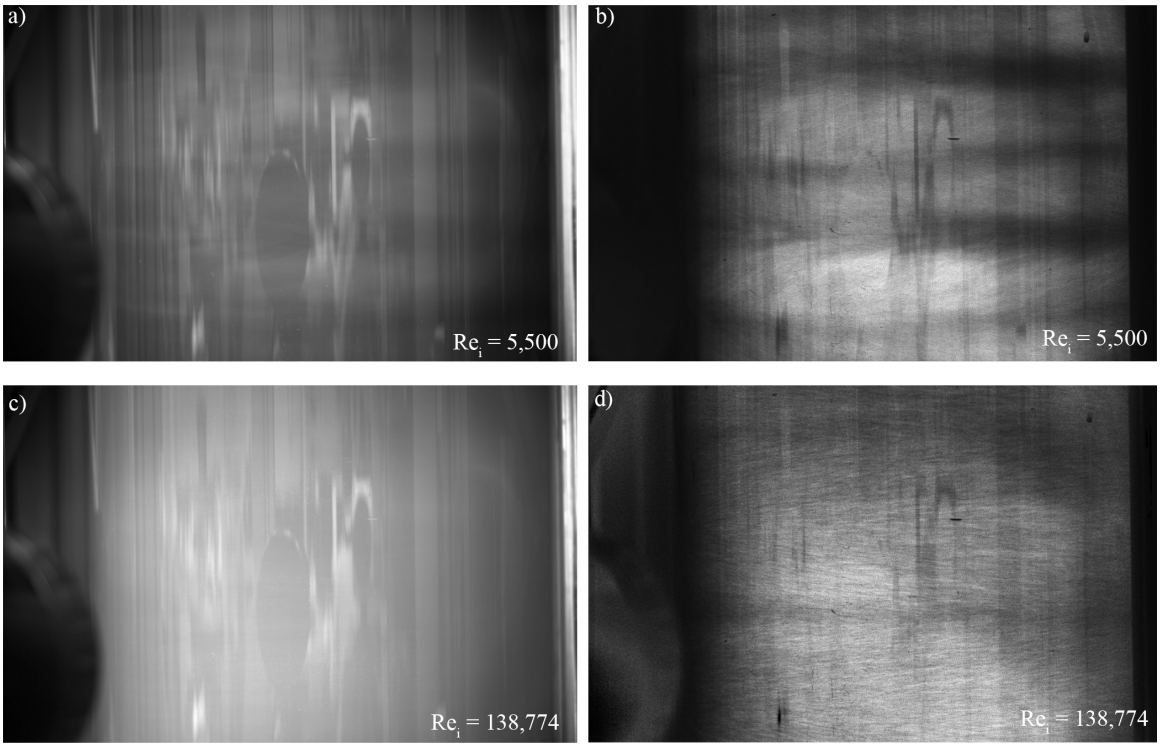

Figure S-1: Flow visualization using a rheoscopic fluid (with water as the working fluid) at $\mathrm{Re_i} = 5550$ (a, b) and $\mathrm{Re_i} \approx 1.4 \times 10^5$ (c, d). (Panels b and d are the same as Fig. 2c.) The corresponding movies are included in the Supplementary Material. For clearer visualization, we processed the images by subtracting the previous frame from the current frame. In the movies, we show both the unprocessed and post-processed data for comparison. Here we show time-averaged images (averaged over ~ 500 frames) of the unprocessed (left panels) and processed data (right panels).

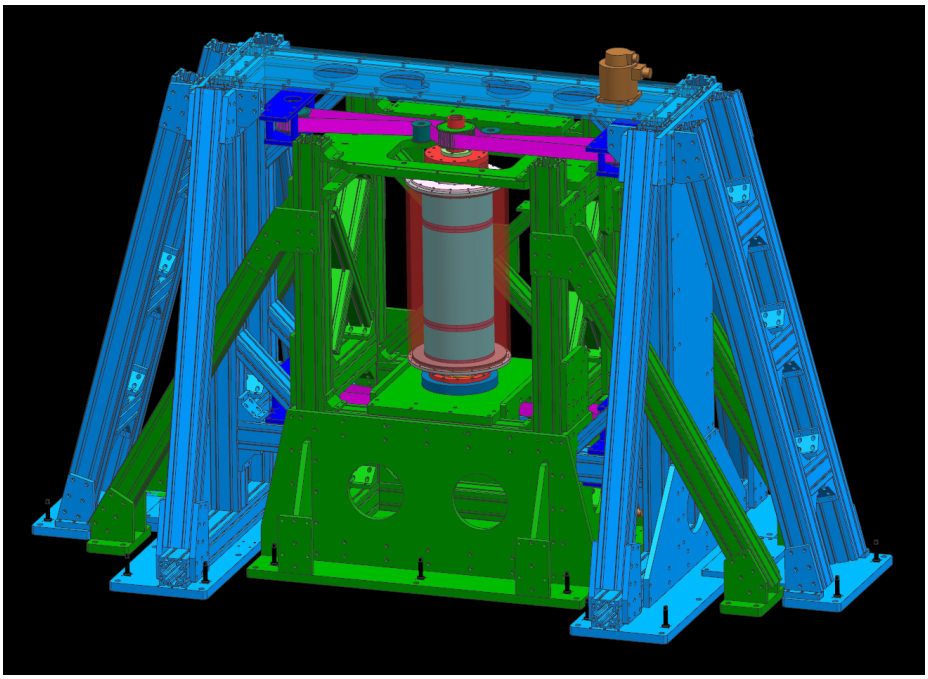

Figure S-2: A volumetric rendering of the split-frame design. The main frame (colored green) and the motor frame (colored blue) are structurally disjoint. Both the motors are mounted on the motor frame. Timing belts (colored pink) transmit torques from the motors to the cylinders. To visualize the timing belts connected to the top motor, we have removed a facing plate and a supporting beam from the top of the main frame.

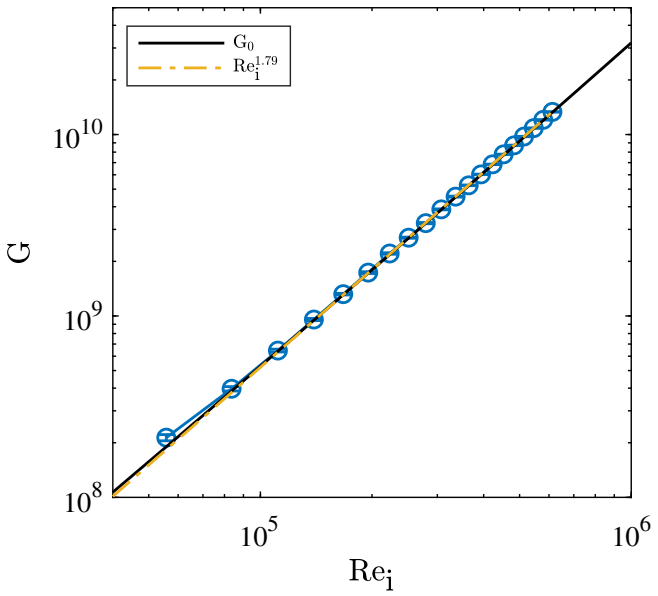

Figure S-3: G vs. $\mathrm{Re_i}$ for $\mathrm{Ro}^{-1} = 0$. The data is the same as in Fig. 8a for $\mathrm{Ro}^{-1} = 0$ (except the abscissa is changed to $\mathrm{Re_i}$). We also show the corresponding $\mathrm{G_0}$ curve and the best-fit power-law ($\mathrm{G} \propto \mathrm{Re_i}^{1.79}$). For comparing the power-law fit, we note that Wendt's pioneering experiments [2] yield $\mathrm{G} \propto \mathrm{Re_i}^{1.7}$ for $10^4 < \mathrm{Re_i} < 10^5$ and Tong *et al.*'s experiments [1] yield $\mathrm{G} \propto \mathrm{Re_i}^{1.8}$ for $4 \times 10^4 < \mathrm{Re_i} < 4 \times 10^5$. We also note that the $\mathrm{G_0}$ curve and the power-law fit are practically indistinguishable over the range of $\mathrm{Re_i}$ plotted here.

References

[1] P. Tong, W. Goldburg, J. Huang, and T. Witten, *Anisotropy in turbulent drag reduction*, Phys. Rev. Lett., 65 (1990), p. 2780.

[2] F. Wendt, *Turbulente Strömungen zwischen zwei rotierenden konaxialen Zylindern*, Ingenieur-Archiv, 4 (1933), pp. 577–595.