Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Controlling secondary flows in Taylor-Couette flow using inhomogeneous boundary conditions[1] VIGNESH JEGANATHAN, KAMRAN ALBA, RODOLFO OSTILLA MONICO, University of Houston — Taylor-Couette (TC) flow, the flow between two independently rotating and co-axial cylinders, is known to have pinned secondary flows known as Taylor rolls. We study the possibility of affecting these secondary structures using one- and two-dimensional patterns of stress-free and no-slip boundary conditions on the inner cylinder. For this, we perform direct numerical simulations of TC flow with pure inner cylinder rotation at three different shear Reynolds numbers up to $Re_s = 10^4$, fixing the radius ratio to $\eta = 0.909$. We find that one-dimensional streamwise patterns do not have a significant effect on the flow, whereas one-dimensional spanwise patterns disrupt the rolls and decrease the torque substantially. Two-dimensional spiral inhomogeneities lie somewhere between the previous two cases, affecting the torque and moving the pinned secondary flows. We quantify the roll's movement for various angles and the widths of the spiral pattern, and find that the maximum speed occurs at a certain angle and width of the spiral pattern. Finally, we find that two-dimensional checkerboard patterns do not affect the flow or the torque substantially.

[1]We acknowledge funding from the National Science Foundation through grant NSF-CBET-1934121.

Vignesh Jeganathan
University of Houston

Date submitted: 30 Jul 2020 Electronic form version 1.4