Mirror symmetric travelling wave solutions in sliding Couette flow and plane Couette flow

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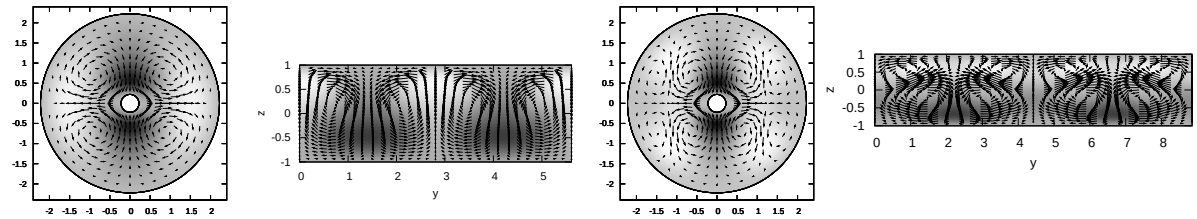
K. Deguchi*, M. Nagata†

* Department of Aeronautics and Astronautics, Graduate School of Engineering
Kyoto University, Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501 Japan
e-mail: ken5-d@t06.mbox.media.kyoto-u.ac.jp

† Department of Aeronautics and Astronautics, Graduate School of Engineering
Kyoto University, Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501 Japan
e-mail: nagata@kuaero.kyoto-u.ac.jp

ABSTRACT

Sliding Couette flow (SCF) is a flow between two infinitely long concentric cylinders with radii a and b ($b > a$) subject to a sliding motion of the inner cylinder in the axial direction relative to the outer cylinder. In the narrow limit of the gap (*i.e.*, the radius ratio $\eta \equiv a/b \to 1$), SCF becomes identical to plane Couette flow (PCF). We continued the nonlinear solution in PCF [2] to SCF and found bifurcations of two types of mirror symmetric solutions [1]. The difference of these two types is the number of vortices in their averaged velocity field: the one of them, $\mathcal{M}_4$, has four vortices whereas the other, $\mathcal{M}_8$, has eight (see Figures 1 (a) and (c)). In this short paper we describe the continuation of these two types back to $\eta = 1$ and report on their counterparts, new travelling waves, in SCF (see Figures 1 (b) and (d)).



(a): $\mathcal{M}_4$ $(\eta = 0.1)$ (b): $\mathcal{M}_4$ $(\eta = 1)$ (c): $\mathcal{M}_8$ $(\eta = 0.1)$ (d): $\mathcal{M}_8$ $(\eta = 1)$

Figure 1: The fluctuation part of streamwise averaged velocity field of mirror symmetric travelling waves $\mathcal{M}_4$ and $\mathcal{M}_8$ in SCF $(\eta = 0.1)$ and PCF $(\eta = 1)$ (light: fast, dark: slow).

REFERENCES

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[2] M. Nagata *Three-dimensional finite amplitude solutions in plane Couette flow: bifurcation from infinity*, J. Fluid Mech. **217**, 519-527, 1990.