Supplementary Materials to "Bifurcation phenomena in Taylor-Couette flow in a very short annulus with radial through-flow"

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Legends for videos in SM

- movie_T2_alpha-3_7.avi:
  movie_T2_alpha-3_7.avi demonstrates the $\mathrm{T2}_2^{\mathrm{puls}}$ solutions at $Re_1 = 250$, $Re_o = -250$, and $\alpha = -3.8$. Period time $\tau^{\mathrm{puls}} \approx 0.194$. *Top left:* Radial velocity $u(\theta, z)$ on an unrolled cylindrical surface in the annulus at the mid-gap [red (yellow) color indicates out (in) flow]. *Top right:* Vector plots $[u(r, z), w(r, z)]$ of the radial and axial velocity component $(\theta = 0)$ where the color-coded azimuthal velocity field, v, is also shown. Solid black line indicates $v = 0$. *Bottom center:* Isosurfaces of the azimuthal vorticity, $\eta = \pm 240$ [red (yellow) color indicates positive (negative) vorticity]. *Bottom left:* Contours of azimuthal velocity field, v, in the (r, θ) plane at mid-height (viewed from the bottom). Thick black arrows highlight the rotation direction of the inner cylinder.

- movie_pV1_alpha0.avi:
  movie_pV1_alpha0.avi demonstrates the pV_1 solutions at $Re_1 = 250$, $Re_o = -250$, and $\alpha = 0$. Period time $\tau \approx 0.641$. *Top left:* Radial velocity $u(\theta, z)$ on an unrolled cylindrical surface in the annulus at the mid-gap [red (yellow) color indicates out (in) flow]. *Top right:* Vector plots $[u(r, z), w(r, z)]$ of the radial and axial velocity component $(\theta = 0)$, where the color-coded azimuthal velocity field, v, is also shown. Solid black line indicates $v = 0$. *Bottom center:* Isosurfaces of the azimuthal vorticity, $\eta = \pm 240$ [red (yellow) color indicates positive (negative) vorticity]. *Bottom left:* Contours of azimuthal velocity field, v, in the (r, θ) plane at mid-height (viewed from the bottom). Thick black arrows highlight the rotation direction of the inner cylinder.

- movie_pV2_alpha07.avi:
  movie_pV2_alpha07.avi demonstrates the pV_2 solutions at $Re_1 = 250$, $Re_o = -250$, and $\alpha = 0.7$. Period time $\tau \approx 1.395$. *Top left:* Radial velocity $u(\theta, z)$ on an unrolled cylindrical surface in the annulus at the mid-gap [red (yellow) color indicates out (in) flow]. *Top right:* Vector plots $[u(r, z), w(r, z)]$ of the radial and axial velocity component $(\theta = 0)$, where the color-coded azimuthal velocity field, v, is also shown. Solid black line indicates $v = 0$. *Bottom center:* Isosurfaces of the azimuthal vorticity, $\eta = \pm 240$ [red (yellow) color indicates positive (negative) vorticity]. *Bottom left:* Contours of azimuthal velocity field, v, in the (r, θ) plane at mid-height (viewed from the bottom). Thick black arrows highlight the rotation direction of the inner cylinder.

- movie_pV2_alpha1.avi:
  movie_pV2_alpha1.avi demonstrates the pV_2 solutions at $Re_1 = 250$, $Re_o = -250$, and $\alpha = 1$. Period time $\tau \approx 0.896$. *Top left:* Radial velocity $u(\theta, z)$ on an unrolled cylindrical surface in the annulus at mid-gap [red (yellow) color indicates out (in) flow]. *Top right:* Vector plots $[u(r, z), w(r, z)]$ of the radial and axial velocity component $(\theta = 0)$, where the color-coded azimuthal velocity field, v, is also shown. Solid black line indicates $v = 0$. *Bottom center:* Isosurfaces of the azimuthal vorticity, $\eta = \pm 240$ [red (yellow) color indicates positive (negative) vorticity]. *Bottom left:* Contours of azimuthal velocity field, v, in the (r, θ) plane at mid-height (viewed from the bottom). Thick black arrows highlight the rotation direction of the inner cylinder.

- movie_pV2_alpha2.avi:
  movie_pV2_alpha2.avi demonstrates the pV_2 solutions at $Re_1 = 250$, $Re_o = -250$, and $\alpha = 2$. Period time $\tau \approx 0.405$. *Top left:* Radial velocity $u(\theta, z)$ on an unrolled cylindrical surface in the annulus at the mid-gap [red (yellow) color indicates out (in) flow]. *Top right:* Vector plots $[u(r, z), w(r, z)]$ of the radial and axial velocity component $(\theta = 0)$, where the color-coded azimuthal velocity field, v, is also shown. Solid black line indicates $v = 0$. *Bottom center:* Isosurfaces of the azimuthal vorticity $\eta = \pm 240$ [red (yellow) color indicates positive (negative) vorticity]. *Bottom left:*

Contours of azimuthal velocity field, v, in the (r, θ) plane at mid-height (viewed from the bottom). Thick black arrows highlight the rotation direction of the inner cylinder.