

Numerical Simulations of Three-Dimensional Instabilities in Cavity Flows

Thesis by
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List of Movies

- **2DMovie2.1.avi**

Flow field representative of all the two-dimensional simulations with shear-layer (Rossiter) mode oscillations (2D run 0NR3 not reported in appendix A: $L/D = 2$, $M = 0.8$, $L/\theta_0 = 76.9$, $Re_D = 1500$). Top: 21 equi-spaced contours of the dilatation field between $\nabla u D/U = -0.5$ and 0.5; Bottom: 21 equi-spaced contours of the spanwise vorticity field between $\omega_z D/U = -5$ and 5.

- **3DMovie5.1.avi**

Vorticity field for 3D run 2M0325-3D ($L/D = 2$, $\Lambda/D = 2$, $M = 0.325$, $L/\theta_0 = 52.8$, $Re_D = 1500$). Ten equi-spaced translucent iso-surfaces of the spanwise vorticity are represented for $\omega_z D/U = -5$ to 5. Only the three-dimensional centrifugal instability is present.

- **3DMovie5.2.avi**

Spanwise velocity for 3D run 2M0325-3D. 5 equi-spaced translucent iso-surfaces of the spanwise velocity are represented for $w/U = -0.02$ to 0.02. The formation of unsteady spanwise structures can be observed.

- **3DMovie5.3.avi**

Vorticity field for 3D run 2M06-3D ($L/D = 2$, $\Lambda/D = 2$, $M = 0.6$, $L/\theta_0 = 52.8$, $Re_D = 1500$). Ten equi-spaced translucent iso-surfaces of the spanwise vorticity are represented for $\omega_z D/U = -5$ to 5. Both shear-layer (Rossiter) mode oscillations and three-dimensional cen-

trifugal instability are present.

- **3DMovie5.4.avi**

Spanwise velocity for 3D run 2M06-3D. 5 equi-spaced translucent iso-surfaces of the spanwise velocity are represented for $w/U = -0.02$ to 0.02 . Again, the formation of unsteady spanwise structures can be observed, along with their interaction with the shear layer.

- **3DMovie5.5.avi**

Vorticity field for 3D run H1Re300-3D ($L/D = 1$, $\Lambda/D = 2$, $M = 0.6$, $L/\theta_0 = 23.2$, $Re_D = 6960$). Ten equi-spaced translucent iso-surfaces of the spanwise vorticity are represented for $\omega_z D/U = -5$ to 5 . The shear-layer (Rossiter) mode oscillations and both steady and unsteady three-dimensional centrifugal instabilities are present.

- **3DMovie5.6.avi**

Spanwise velocity for 3D run H1Re300-3D. 5 equi-spaced translucent iso-surfaces of the spanwise velocity are represented for $w/U = -0.02$ to 0.02 . The formation of both steady and unsteady spanwise structures can be observed.

- **2DMovieC.1.avi**

Vorticity field for the 2D run Rkw ($L/D = 1$, $M = 0.3$, $L/\theta_0 = 142$, $Re_\theta = 106$). Apart from the Mach number, the other flow parameters match the experimental conditions by Rockwell and Knisely. In this case, $Re_D = 15000$. 30 equi-spaced contours of the spanwise vorticity between $\omega_z D/U = -15$ and 15 are shown.

- **2DMovieD.1.avi**

Vorticity field for the 2D run 2M06 ($L/D = 2$, $M = 0.6$, $L/\theta_0 = 52.8$, $Re_D = 1500$). 20

equi-spaced contours of the spanwise vorticity between $\omega_z D/U = -5$ and 5 are shown. The flow oscillates in shear-layer (Rossiter) mode.

- **2DMovieD.2.avi**

Vorticity field for the 2D run **4M06wake** ($L/D = 4$, $M = 0.6$, $L/\theta_0 = 52.8$, $Re_D = 1500$). 20 equi-spaced contours of the spanwise vorticity between $\omega_z D/U = -5$ and 5 are shown. By increasing the cavity aspect ratio from 2 to 4, the flow now oscillates in wake mode.

- **3DMovieD.3.avi**

Vorticity field for the 3D run **4M06wake-3D** ($L/D = 4$, $\Lambda/D = 1.25$, $M = 0.6$, $L/\theta_0 = 52.8$, $Re_D = 1500$). Ten equi-spaced contours of the spanwise vorticity between $\omega_z D/U = -5$ and 5 are shown. Without spanwise disturbances, the flow is uniform in the spanwise direction and still oscillates in wake mode.

- **3DMovieD.4.avi**

Vorticity field for the 3D run **4M06-3D** ($L/D = 4$, $\Lambda/D = 1.25$, $M = 0.6$, $L/\theta_0 = 52.8$, $Re_D = 1500$). Ten equi-spaced contours of the spanwise vorticity between $\omega_z D/U = -5$ and 5 are shown. With spanwise disturbances, the flow switches back to shear-layer (Rossiter) mode.