Supplemental material

Why cavities resonate? A possible explanation in terms of pressure and kinetic energy transport across the cavity mouth

Peter Roger Bailey♮, Antonella Abbá♯, and Daniela Tordella♮*

♮ *Dipartimento di Ingegneria Aeronautica e Spaziale, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Torino, Italy and*

♯ *Dipartimento di Matematica, Politecnico di Milano, Via Bonardi 9, 20133 Milano, Italy*

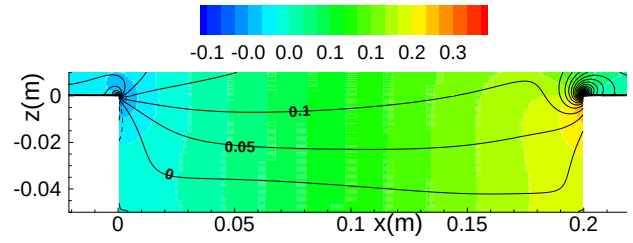
(Dated: July 27, 2012)

PACS numbers: 47.27+, 47.51+, 47.15.Rq

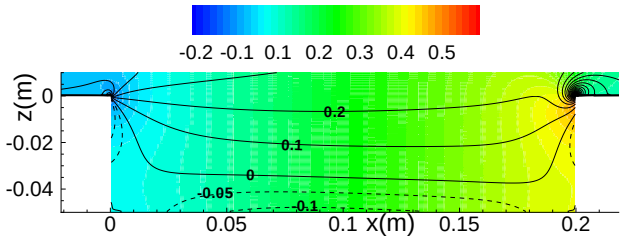
*Electronic address: daniela.tordella@polito.it

This PDF file includes the following material:

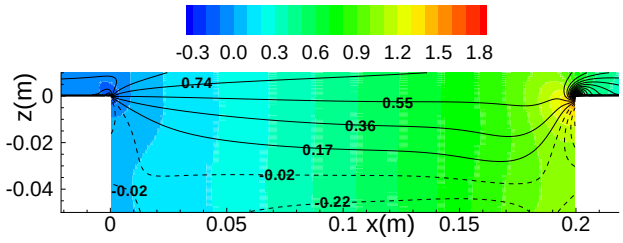
The visualization of the pressure levels, vorticity contours, kinetic energy levels and streamlines in the cavity flow for the range of values $50 - 2900$ of the Reynolds number based on the channel bulk speed. The two figures below correspond to the content of figure 2 in the main paper. The difference in this enlarged version is that the levels of the contour lines are quantified.



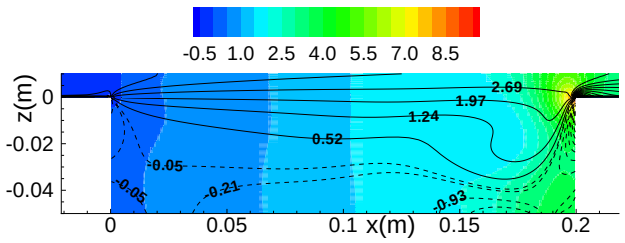
(a) $R_h = 50$



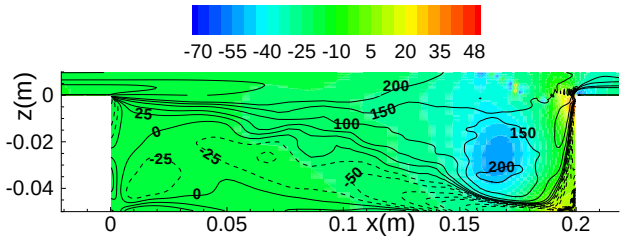
(b) $R_h = 100$



(c) $R_h = 250$

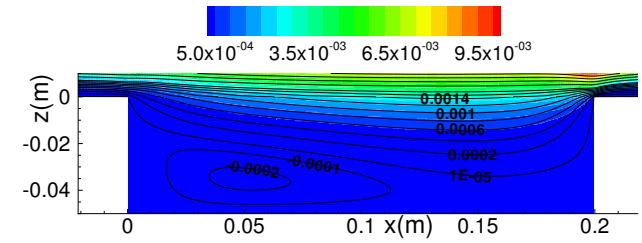


(d) $R_h = 1000$

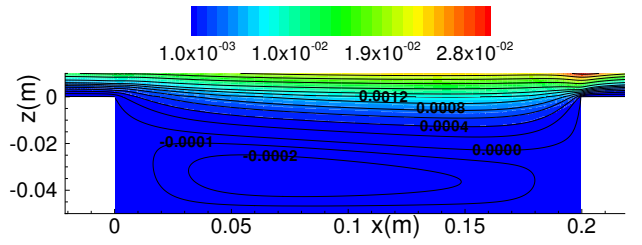


(e) $R_h = 2900$

FIG. 1: Visualization of the pressure and spanwise vorticity inside the cavity. Flows in the R_h range $[50, 2900]$. Laminar flows. Panels 1(a),1(b),1(c),1(d): pressure field $(p - p_a)$ (in mPa) and contour levels for the spanwise vorticity component, where p_a is the pressure at the channel inlet. The averaged turbulent flow at $R_h = 2900$ is represented in panels 1(e), distributions of the mean pressure $(p - p_a)$ and mean spanwise vorticity component. The mean values are computed by averaging in time over 16 flow time scales and in space over the spanwise direction. Since we want to give a qualitative picture of the flow, contour levels for the spanwise vorticity component are not equispaced and values for the best representation have been selected.

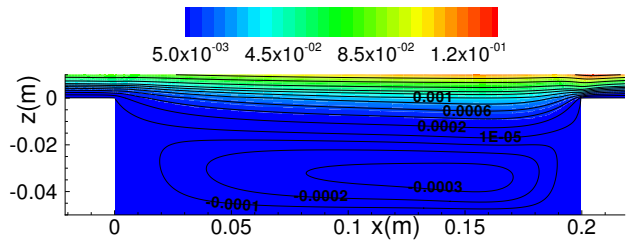


$R_h = 50$



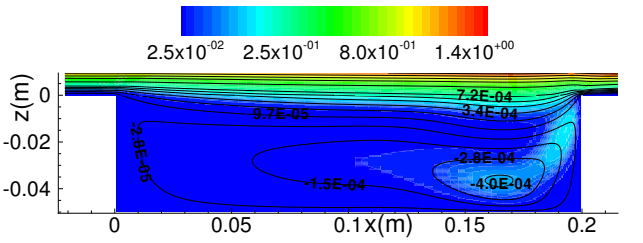
$R_h = 100$

(a)



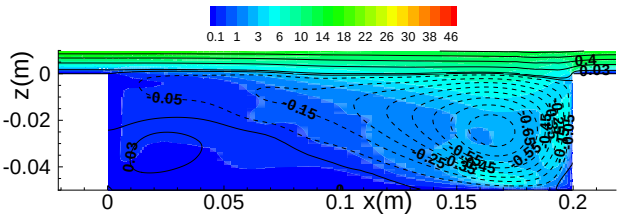
$R_h = 250$

(b)



$R_h = 1000$

(c)



$R_h = 2900$

(d)

FIG. 2: Visualization of the kinetic energy field and streamlines inside the cavity. Flows in the R_h range $[50, 2900]$. Laminar flows. Panels ,2(a),2(b),2(c): kinetic energy (in J) and velocity streamlines. The mean kinetic energy distribution and mean velocity streamlines for the turbulent flow at $R_h = 2900$ is represented in panel 2(d). The mean values are computed by averaging in time over 16 flow time scales and in space over the spanwise direction. The principal eddy tends to a position in the downstream half of the domain and the secondary eddy grows with R_h. Since we want to give a qualitative picture of the flow, contour levels for the streamlines are not equispaced and values for the best representation have been selected.