

# - BIFD2011 - Stability of 2D natural convection flows in differentially heated cavities: 2D/3D Disturbances

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## ABSTRACT

Natural convection in differentially heated cavities became a reference problem for testing the CFD codes after the well-known workshop on steady flow regime [2]. Its stability with respect to 2D disturbances has been widely studied afterwards ([5, 7, 10, 4] among others) and another workshop on unsteady air flows and transition to time-dependant flows was held on 2002 ([1, 12] among others).

Due to important developments related to time-stepping methods [8, 3, 6, 9], accurate numerical studies have been performed on stability analysis of 2D natural convection flows in differentially heated cavities [11, 12, 13]: 2D disturbances were studied mainly. In order to complete previous studies, 3D disturbances were studied for air-filled cavities with adiabatic horizontal walls and this allowed to know which kind of disturbances between 2D and 3D ones are more unstable, in which case 2D studies remain meaningful and in which case 3D investigations are necessary.

In a square cavity with conducting horizontal walls, 2D base flows become first unstable with respect to 3D stationary modes for  $Pr < 1$ , 3D oscillatory modes for  $Pr = 1$  and 2D oscillatory modes for  $Pr > 3$ . In air-filled cavities with adiabatic horizontal walls, 2D base flows become first unstable with respect to 3D oscillatory modes for aspect ratios between 1 and 7 and 2D oscillatory modes for aspect ratios  $\geq 8$ . It is to note that the only 3D unstable mode which is clearly connected to the 2D unstable modes was observed for  $Pr = 1$  in a square cavity with conducting horizontal walls.

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