

Synopsis

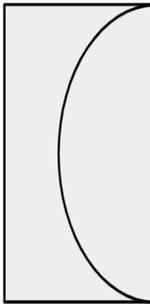
Effect of Convexity on onset of Rayleigh-Benard Convection in Convex and Concave Cylinders

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Abstract

The objective of this study is to conduct a simulation of the onset of Rayleigh-Bénard convection in a cylindrical cavity of either concave or convex shape. A piece of the cavity, having center line as axi-symmetric is simulated for that purpose. Rayleigh-Benard Convection is a special type of natural convection having thermal gradient anti-parallel to the gravity which occurs when thermally driven buoyancy dominates over viscosity forcing resulting in the formation of convective rolls after the onset. These rolls possess a structure that is ideal for thermally activated polymerized chemical chain reactions through temperature cycling, [1]. Current work investigates the the stability dependence of RBC on convexicity of cylindrical cavity. Benchmark of Openfoam simulations have been done with works on Rayleigh-Benard Convection in square cavities [2,3].



Reference

[1] MADHAVI KRISHNAN, VICTOR M. UGAZ, AND MARK A. BURNS; “PCR in a Rayleigh-Bénard Convection Cell”. *SCIENCE*, Vol: 298, Issue- 5594, p. 793 (25 Oct 2002). DOI: 10.1126/science.298.5594.793

[2] Nasreddine Ouertatani, Nader Ben Cheikh, Brahim Ben Beya, Taieb Lili; “Numerical simulation of two-dimensional Rayleigh-Bénard convection in an enclosure”. *C. R. Mecanique* 336 (2008) 464–470. doi:10.1016/j.crme.2008.02.004

[3] DANIELE VENTURI, XIAOLIANG WAN, GEORGE EM KARNIADAKIS; “Stochastic bifurcation analysis of Rayleigh-Bénard convection”. *Journal of Fluid Mechanics* , Volume 650 , 10 May 2010 , pp. 391 - 413. DOI: <https://doi.org/10.1017/S0022112009993685>

