Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Phase transitions analogy for cavity flows. PETRU FODOR, MIRON KAUFMAN, Physics, Cleveland State University — The fluid flow in cavity type systems, in which one of the walls is moving while the others are stationary, is analyzed using computational modeling, under the assumption of no-slip boundary conditions. By iteratively adapting the mesh used, we are able to map with high spatial resolution the complex flow structures that form at the two types of corners of the cavity, i.e. (i) corners defined by stationary walls, and (ii) corners defined by a stationary and the moving wall, respectively. For the structures that form in the vicinity of the fixed points defined by the corners, we observe that the flow magnitudes and spatial distributions follow scaling laws similar with critical phenomena. In particular, the behavior at the first type of corner is analogous to a to a first-order transition (discontinuity) point, while the behavior at the second one is analogous to a thermodynamic critical point (second-order transition). These results provide a unique insight into the solution to Navier-Stokes equations for cavity flows.

Petru Fodor
Physics, Cleveland State University

Date submitted: 22 Oct 2015 Electronic form version 1.4