1033-35-159 **C.M. Fan*** (d91521006@ntu.edu.tw), Department of Mathematics, 118 College Dr., #5045, Univeristy of Southern Mississippi, Hattiesburg, MS 39406, **C.L. Chiu**, Department of Civil Engineering, National Taiwan University, Taipei, Taiwan, and **D.L. Young**, Department of Civil Engineering, National Taiwan University, Taipei, Taiwan. *3D immersed-boundary finite-element analysis of heat and flow patterns in a two-roll mill.* Preliminary report.

A fully three-dimensional Navier-Stokes model has been developed to numerically investigate the heat and flow patterns of the two-roll mill with two inner rotating cylinders. The time-dependent Navier-Stokes equations are discretized by finite element and immersed boundary methods on a fixed Cartesian grid, so the mesh generation on irregular domain is not needed in our study. In order to speed up the numerical process, the operator-splitting scheme with the BTD term is used to advance the solution in time evolution. In authors' previous study, the 2D numerical model has been performed to analyze the cross-section of two-roll-mill flow under the assumption of infinite length in the vertical direction. However, the 2D solutions could not completely represent the realistic 3D phenomena. In this study, the special attentions are paid to numerically investigate the vertical heat and flow behaviors, including the vortex structure, periodic and chaotic instabilities. (Received September 09, 2007)