On Singularity Formation of a 3D Model for Incompressible Navier-Stokes Equations

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Abstract:

We investigate the singularity formation of a 3D model that was recently proposed by Hou and Lei in [1] for axisymmetric 3D incompressible Navier-Stokes equations with swirl. The main difference between the 3D model of Hou and Lei and the reformulated 3D Navier-Stokes equations is that the convection term is neglected in the 3D model. This model shares many properties of the 3D incompressible Navier-Stokes equations. One of the main results of this paper is that we prove rigorously the finite time singularity formation of the 3D model for a class of initial boundary value problems with smooth initial data of finite energy. We also prove the global regularity for a class of smooth initial data.

References:
1. Thomas Y. Hou and Z. Lei, On the Stabilizing Effect of Convection in Three-Dimensional Incompressible Flows*Comm. Pure Appl. Math.*, **62**, pp. 501-564, 2009.