University of Venda

A Masters Dissertation

Existence and Uniqueness of a solution to a flow problem about a
Rotating Obstacle at low Reynolds number

By

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Abstract

The flow is described by the Navier-Stokes equations in the domain $\Omega \subset R^3$. The open-bounded domain is assumed to have a cone property. The rotation of a 3- dimensional symmetrical impermeable cylindrical rigid body in the fluid is studied. The model is constructed in a manner that the equations describe a system in a frame attached to the obstacle.The system of the governing equations is constructed on the basis of conservation of angular momentum of the rigid body and the conservation of linear momentum of the fluid. When the conservation of angular momentum is taken into account, a dynamic boundary condition is considered. The uniqueness of this unknown velocity vector field is confirmed by using the so called energy method. In this study we chose the incompressible viscous Navier-Stokes flow and thus the fluid density does not change through out the flow.