



Weak Singular Solution of Six Coupled Nonlinear ODEs

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Abstract: In this paper we have investigated the complete integrability of the system of six coupled nonlinear ODEs (ordinary differential equations), which arose in the ODE reduction of uniformly stratified fluid contained in rotating rectangular box of dimension $L \times L \times H$. The reduced system is completely integrable if the Rayleigh number $Ra = 0$. Whereas, $Ra \neq 0$ is the case of non integrability and we have obtained the solutions in the form of logarithmic psi-series. We conclude that weak singular solutions exist with movable pole type singularity, which are cluster in a self-similar fashion.

Keywords: *completely integrable systems; non-integrable systems; Painlevé test; singular solutions.*

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1 Introduction

In the fluid dynamics, the flow of fluid in the atmosphere and in the ocean is governed by Boussinesq equations. Majda and Shefter [3] analyzed certain ODE reduction of Boussinesq equations. Srinivasan et al. [15] extended this work and they gave the detail mathematical analysis of reduced system of six coupled ODEs. Whereas, Desale and Dasre [5] wrote the C-Programme to determine the numerical solutions on stable and unstable manifolds. Furthermore, Desale [4] had given the complete analysis of the system and also tested the system for complete integrability by determining four first integrals and used the Jacobi's theorem. Also, he has demonstrated the stability of non degenerate critical point. For the similar text of bifurcation analysis near the degenerate

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