Painlevé Test to a Reduced System of Six Coupled Nonlinear ODEs

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Received: March 17, 2010; Revised: September 27, 2010

\textbf{Abstract:} In this paper we investigate the complete integrability of the system of six coupled nonlinear ODEs, which arises in the ODE reduction of rotating stratified Boussinesq equations. We use Painlevé test to investigate the complete integrability of the system. And we conclude that the system is completely integrable only if the Rayleigh number $Ra = 0$. The singular solution of the system admits the movable pole type singularity in complex domain.

\textbf{Keywords:} Painlevé test; rotating stratified Boussinesq equations; integrable system.

\textbf{Mathematics Subject Classification (2000):} Primary 37K10, Secondary 76B70.

1 Introduction

We undertake the Painlevé analysis of the system of six coupled nonlinear ODEs arising as a reduction of rotating stratified Boussinesq equations. The rotating stratified Boussinesq equations form a system of partial differential equations modelling the movement of planetary atmosphere. In their study of instability in stratified fluids at large Richardson number, Majda and Shefter \cite{1} analyzed certain system of ODE reduction of stratified Boussinesq equations. Srinivasan et al \cite{2} gave the complete analysis of reduced system of ODEs and discussed the stability of degenerate critical point. In their paper Desale and Srinivasan \cite{3} examine the same system in the light of the ARS (Ablowitz, Ramani and Segur \cite{4}) conjecture. Ablowitz, Ramani and Segur have conjectured that a system of PDEs is completely integrable if all its ODE reductions are of Painlevé type. The conjecture has been tested on large class of differential equations and has since been