



# Singular Analysis of Reduced ODEs of Rotating Stratified Boussinesq Equations Through the Mirror Transformations

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**Abstract:** In this paper we have considered the system of six coupled non-linear ordinary differential equations (ODEs), which arose in the reduction of uniformly stratified fluid contained in a rotating rectangular box of dimension  $L \times L \times H$  which is completely integrable if the Rayleigh number  $Ra = 0$ . In our investigations, we have shown that there exists a regular mirror system near movable singularities of these integrable ODEs. Moreover, we have used the mirror system to prove the convergence of Laurent series solutions obtained by the Painlevé method.

**Keywords:** *mirror transformation; mirror system; Painlevé test.*

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## 1 Introduction

In general, we believed that the differential system is integrable due to some sort of underlying linear structure(s). But, when it comes to this concept, it is never clear what does it mean. On the other hand the integrability of nonlinear system is quite ambiguous. In this connection many mathematicians started to work over the investigation of integrability of nonlinear system. In 1889, Sophie Kowalevski [12] proved the complete integrability of the system of ordinary differential equations (ODEs) governing the motion of a spinning top moving under the influence of gravity. In her study, she was seeking

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