Complete Analysis of an Ideal Rotating Uniformly Stratified System of ODEs

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Abstract: In this paper we discuss a system of six coupled ODEs which arise in ODE reduction of the PDEs governing the motion of uniformly stratified fluid contained in rectangular basin of dimension $L \times L \times H$, which is temperature stratified with fixed zeroth order moments of mass and heat. We prove that this autonomous system of ODEs is completely integrable if Rayleigh number $Ra = 0$ and determine the stable, unstable and center manifold passing through the rest point and discuss the qualitative feature of the solutions of this system of ODEs.