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Rational and Semi-Rational Solutions to the Nonlocal Mel'nikov Equation *via* Determinants

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Note on the Solving the Laplace Tidal Equation with Linear Dissipation

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In this paper, we present a new solving procedure for *Laplace tidal equations* (LTEs) with linea dissipation: the analytic algorithm is implemented here for solving momentum equation of LTEs where the dissipation term with linear dependence on velocity field of fluid flow has been additionall taken into consideration (which is supposed to approximate the decreasing of momentum for th Ocean's flows due to the viscous friction between Ocean's layers if we consider heat fluxes during th lost of energy inside the Ocean) As a main result of this work, a new ansatz is suggested here for solving LTEs with linear dissipation solving momentum equation is reduced to solving a system of three linear ordinary differentia equations of first order with regard to three components of the flow velocity (depending on time t) along with mandatory using the continuity equation that determines the spatial part of solution In our derivation, the main motivation is the proper transformation of the previously presented system of equations to a convenient form, in which the minimum of numerical calculations are required t obtain the final solutions. Preferably, it should be the analytical solutions; we have presented th solution as a *linear combination* of linearly independent fundamental solutions (of real and comple values). We pointed out also the elegant case of partial solution for velocity field of real value Nevertheless, we should use the continuity equation for identifying the spatial components of velocit field in the case of nonzero fluid pressure in the Ocean, along with nonzero total gravitational potentia and the centrifugal potential (due to planetary rotation). It means that the system of Laplace tida equations with additional *linear dissipation* term (in momentum equation) could not be solve analytically.

NOTE ON THE SOLVING THE LAPLACE TIDAL EQUATION WITH LINEAR DISSIPATION

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Abstract. In this paper, we present a new solving procedure for *Laplace tidal equations* (LTEs) with linear dissipation: the analytic algorithm is implemented here for solving momentum equation of LTEs, where the dissipation term with linear dependence on velocity field of fluid flow has been additionally taken into consideration (which is supposed to approximate the decreasing of momentum for the Ocean's flows due to the viscous friction between Ocean's layers if we consider heat fluxes during the lost of energy inside the Ocean).

As a main result of this work, a new ansatz is suggested here for solving LTEs with linear dissipation: solving momentum equation is reduced to solving a system of three linear ordinary differential equations of first order with regard to three components of the flow velocity (depending on time t), along with mandatory using the continuity equation that determines the spatial part of solution.

In our derivation, the main motivation is the proper transformation of the previously presented system of equations to a convenient form, in which the minimum of numerical calculations are required to obtain the final solutions. Preferably, it should be the analytical solutions; we have presented the solution as a *linear combination* of linearly independent fundamental solutions (of real and complex values). We pointed out also the elegant case of partial solution for velocity field of real value. Nevertheless, we should use the continuity equation for identifying the spatial components of velocity field in the case of nonzero fluid pressure in the Ocean, along with nonzero total gravitational potential and the centrifugal potential (due to planetary rotation). It means that the system of Laplace tidal equations with additional *linear dissipation* term (in momentum equation) could not be solved analytically.

Key words: Laplace tidal equations, tidal dissipation, planetary rotation.

1. INTRODUCTION, EQUATIONS OF MOTION

The Laplace tidal equations [1] (LTEs, including continuity equation) describe the dynamics of fluid's velocity under the action of potential forces (including gravity) inside the upper layer of Ocean, which is supposed to be located relatively close to the boundary between the Ocean and the atmosphere of Earth.