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On the two-dimensional tidal dynamics system: stationary solution and stability. (English)

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Summary: In this work, we consider the two-dimensional stationary and non-stationary tidal dynamic equations and examine the asymptotic behavior of the stationary solution. We prove the existence and uniqueness of weak and strong solutions of the stationary tidal dynamic equations in bounded domains using compactness arguments. Using maximal monotonicity property of the linear and nonlinear operators, we also establish that the solvability results are even valid in unbounded domains. Later, we obtain a uniform Lyapunov stability of the steady state solution. Finally, we remark that the stationary solution is exponentially stable if we add a suitable dissipative term in the equation corresponding to the deviations of free surface with respect to the ocean bottom. This exponential stability helps us to ensure the mass conservation of the modified system, if we choose the initial data of the modified system as stationary solution.

MSC:

76U60 Geophysical flows
76E20 Stability and instability of geophysical and astrophysical flows
35Q35 PDEs in connection with fluid mechanics

Keywords:

existence; weak solution; strong solution; monotonicity; exponential stability

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