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Analytical Solutions for Nonlinear Lateral Sloshing in Partially-Filled Elliptical Tankers

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Abstract

Dynamic behavior of the large amplitude lateral sloshing is analytically studied in partially filled elliptical tankers. Theory of elliptical trammel pendulums is employed for modeling of the large oscillation of the fluid inside the elliptical container. Nonlinear governing equation of the motion is derived employing the Hamilton principle. Standard and modified Energy Balance Method (EBM) is adopted as the solution technique. Natural frequencies of the free oscillation are analytically obtained as a function of the initial amplitude. It is proved that the nonlinear dynamical system can behave mutually as a hardening and softening system based on the tanker aspect ratio. A number of numerical simulations are carried out and accuracy of the obtained analytical solution is evaluated.

Session: VIB-2-2 Dynamical systems and Syncrhonization

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