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PROCEEDINGS BOOK

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CONTENT

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LIQUID VIBRATION ANALYSIS IN RIGID TANKS WITH FUZZY DIFFERENTIAL EQUATIONS

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Liquid sloshing is an important phenomenon arisen in a lot of engineering applications. When tanks and reservoirs are partially filled with liquids and subjected to essential external loads, the liquid begins its intensive movement. This motion can lead to very dangerous consequences. It is especially hazardous when the liquid is inflammable and toxic. So considerable amount of research is devoted to studying the dynamical process in fluid-filled tanks and reservoirs [1-3]. A lot of devices were proposed to damp sloshing [1,3] as well as new materials for tank' structures [5]. Last years the concepts of estimating uncertainties became dominant in scientific research [6]. These uncertainties may be observed in sizes of reservoirs, their mechanical characteristics, frequencies and amplitudes of forced loads,

In this paper the approach is considered to simulation of liquid vibrations in rigid tanks under harmonical external excitations. It is supposed that the load amplitude is characterized by a fuzzed triangular number [6,7].

The crisp boundary value problem was solved first as in [2,3]. A cylindrical rigid shell is proposed as the tank model, The liquid inside the tank is supposed to be incompressible and ideal one, and its flow induced by the forced harmonical excitation is potential, in these suppositions there exist a potential Φ that satisfies the Laplace equation. As boundary conditions on she shell wetted surfaces, the no-penetrating stipulation is in use, Dynamic and kinematic boundary conditions are prescribed at the liquid free surface. The boundary integral equation is received for the velocity potential Φ as in [3]. Using kinematic and dynamic boundary conditions, the changing kevel of liquid elevation is estimated. For numerical simulation of the singular boundary equations, we use modified boundary elements methods based on axially-symmetric one-dimensional singular integral evaluations [8,9]. Crisp boundary value problem is reduced to solution of a second order system of differential equations. Here the initial data (free surface location, its velocity, and amplitude of the forced excitation) are given crisp numbers. After receiving the crisp solution of the system of differential equations the initial data are fuzzified [7]. The triangular fuzzy number are in use, so the fuzzy initial value problem is formulated. The numerical solution of this problem is received and analyzed.

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