Two-dimensional fluid model for calculating the natural vibration frequencies of axially symmetric hydro-shell systems

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The article offers a two-dimensional fluid model to describe the vibrational motion of fluid in an elastic thin-walled axially symmetric shell structure. Two-dimensional fluid model is the basis of the approximate analytical method for calculating the natural frequencies of axisymmetric vibrations of hydro-shell systems. The method algorithm consists of a few simple computational operations based on elemental formula conversion of natural frequencies, the transition from the natural frequencies of the shell without liquid to the natural frequencies of a shell filled with liquid. The natural frequencies are determined quickly without any computing facilities. The calculation results obtained in this study by using the proposed two-dimensional fluid model are compared with the exact analytical solutions for the cylindrical shell filled with three-dimensional fluid, with the results for a composite shell structure, obtained by using two finite element complexes (SolidWorks Simulation, Pro/ENGINEER Mechanica), as well as with the results of physical testing frequency (experimental) model — a composite shell of two elements.

Keywords: *tank design, hydroelastic vibrations, fluid model, dynamic characteristics, frequency test*

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