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ABSTRACT BOOK

Editor

Assoc. Prof. Dr. Ayşegül Ayyıldız

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CONTENT

SHELL STRUCTURES INTERACTING WITH LIQUID AND THEIR APPLICATIONS IN BIOMECHANICS

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Abstract

Sloshing phenomenon and fluid-structure interaction problems are very important in transport, aerospace chemical, and automobile industries, and their study is accomplished in research papers [1-4], etc. A lot of research has been devoted to analyzing damp equipment that allow to reduce the sloshing vibration amplitudes. There are passive energy absorbers [5], floating covers [6], vertical and horizontal baffles [7-9].

Recently, there have been appeared some works devoted to the innovative materials application to improve the strength characteristics of liquid storage tanks [10-12].

Another application of shell-like structures interacting with liquids is connected with biomechanics and medicine. Vibrations of eardrum and fluid filled cochlea were considered in [13,14].

The effective numerical method is proposed to analyse different fluid-structure interaction problems. The approach based on the mode superposition method, allow us to consider variety of problems concern with vibrations of elastic structure interacting with liquids. Both boundary and finite element methods as well as their combination have been implemented in numerical simulations. The benchmark tests verify the convergence, accuracy, and reliability of the developed approach. One of the most interesting applications of this method is the possibility of studying the phenomena that occur with the tympanic membrane as a result of the impact load.

The free and forced vibrations of the tympanic membrane the tympanic membrane are investigated. The influence of liquid filling is estimated which is especially important for otitis media patients to prevent the dangerous effects of sound waves. The pressure distribution over the tympanic membrane under impact loads is analyzed. The considered load with a maximum value of 100 kPa, will cause barotrauma, but not entail serious consequences.

But in the case of vulnerable children's membranes, the stresses are very close to the maximum. this can cause not only severe pain, contusions, but also possibly more serious consequences, as bleeding and developmental pathologies in the future. Due to the large scatter in the data on the physical and geometric characteristics of the middle ear, in the future it is supposed to use the developed method with the involvement of the concepts of fuzzy logic [15].

Keywords: free and forced vibrations, sloshing, tympanic membrane, biomechanics.