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DEFORMATION OF THE FLUID-FILLED ELASTIC STRUCTURE UNDER IMPULSE LOADING

This paper is a follow up of the article [1] in which the problem of the influence of destroying of the fluid and bubbles, which are in fluid (bubble fluid), on the deforming of the structure under external impulse loading is brought up. As an example used for the article, it is a structure, which consists of two coaxial cylindrical shells interacting with the help of fluid.

The mathematical statement of thehydroelasticity problem is given in [1]. Let us recall, that the behavior of the fluid medium was considered within three models: ideally elastic, the destructive (cavitating) and bubble fluid. The paper [2] is devoted to dynamics of a gas bubble.

A series of numerical experiments have been conducted for a hydroelasticity boundary problem, formulated in [1]. After that, the received results were analyzed.Calculations for coaxial cylindrical shells were conducted for the outer shell 0,3cm in thickness and with a radius of 100cm, for internal – 0,5cm in thickness and with a radius of 50cm, made from steel. Amplitude of an impulse loading $P_n$was taken to be equal to 1MPa, the duration of whichwas$\tau = 2{,}6 \cdot 10^{-4}$s. The influence of the possible destroying of fluid on deforming of coaxial cylindrical shells using all fluid models mentioned above for calculation has been studied.

So, the change of sags of central points of external and internal shells in time with due account for abody displacement as absolutely rigid, significantly differs when using different fluid models. In fig. 1 it is shown that the curve 1, received when using model of the cavitatingfluid, significantly differs from the curve 2,received from a model of ideal and elastic fluid. Thecurve 3 correspondsto a caseofa bubble fluid. This applies tobothexternalandinternalshells. Numerous experimental studies, that were made,show that calculating of hydroelastic systems under impulse loading needs the consideration of cavitation possibility.

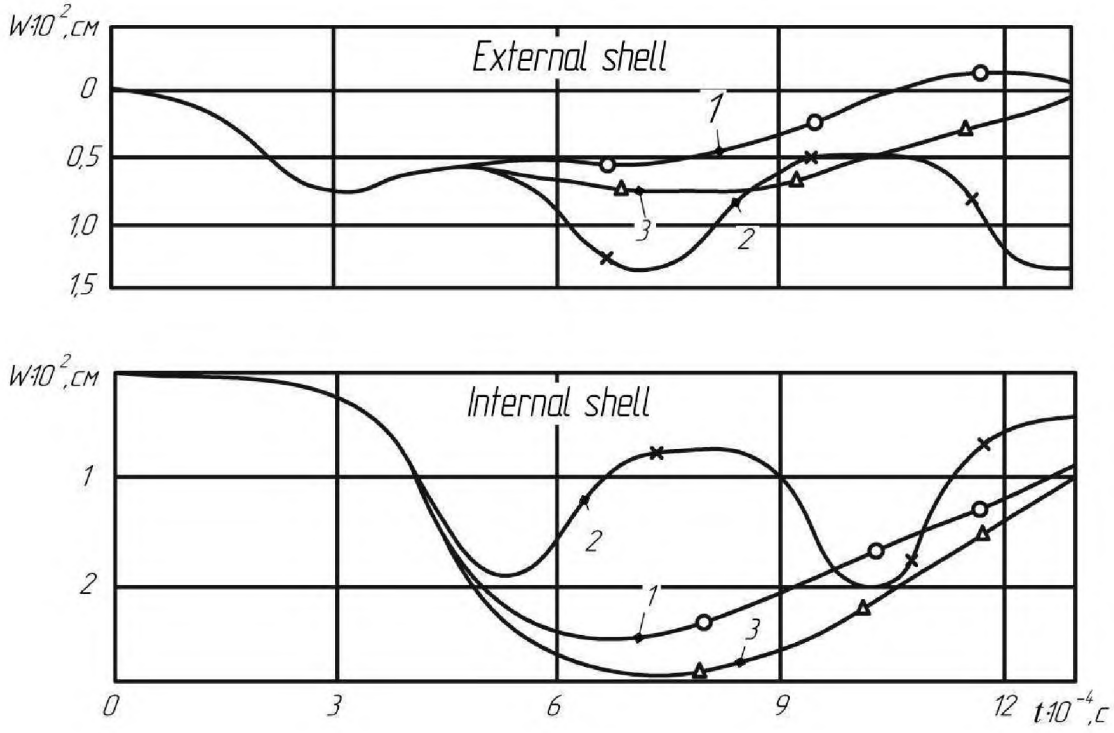

Fig.1. Change of sags of central points of external and internal shells

Omission of fluid destroying leads to considerable mistakes in definition of saga for both external and internal shells with fluid between them.

List of references

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2. Штефан Н.И. //Исследование динамического поведения пузырька газа, находящегося в жидкости // 82 международная научно-техническая конференция, Беларусь, БГТУ, Минск, 2018.