

储液容器的三维流固耦合动力特性分析

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摘要 将储液容器流固耦合系统中的液体和容器分别视为理想可压缩流体和线弹性固体, 采用流体压力单元和固体壳单元对流固耦合系统进行有限元离散, 得到一个非对称的大型流固耦合有限元方程. 采用Arnoldi方法求解上面这个大型有限元方程的非对称特征值问题, 以得到储液容器的动力特性. 通过移频技术避免了处理零频问题, 并构造了迭代格式计算Arnoldi向量. 数值算例表明所用解法对于流固耦合系统都是非常有效的.

关键词 [储液容器](#), [流固耦合](#), [Arnoldi方法](#)

分类号

Dynamic Characteristic Analysis Of Liquid-Filled Tanks As A 3-D Fluid-Structure Coupling System

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Abstract

In this paper, the 3-D liquid-filled tank is considered as a Fluid-Structures Interaction (FSI) system that consists of the ideal, compressible fluid with free surface and the linear, elastic solid with thin thickness. This system is simulated with Finite Element (FE) method. In the FE model, the liquid is discretized by pressure body element and the tank is characterized by displacement shell elements. Since the coupling equation of this FSI system is unsymmetric, Arnoldi's method is adopted to get the dynamic characteristics of the liquid-filled tank. In addition, the shift-frequency technique is introduced to solve the problem of zero frequency and an iteration method is adopted to make the computation both accurate and economical. A numerical simulation of a liquid-filled tank is carried out to confirm the effectiveness of these methods.

Key words [liquid-filled tanks](#) [fluid-structure interaction \(FSI\)](#) [Arnoldi's method](#)

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