

A study of shock-Induced structure cavitation

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ABSTRACT

Shock pressure pulses occurring as a result of an UNDEX (underwater explosion) event excite the ship structure as they impinge on the hull, causing dynamic responses. As this fluid-structure interaction occurs, the total pressure along the hull become negative. Unable to sustain the tension, the water pressure reduces to vapor pressure and structure cavitation occurs. The transient response of a floating structure subjected to structure cavitation is greatly complicated, the investigation of the dynamic response of floating structure to UNDEX become a requirement. Taylor flat plate theory is adopted to estimate the kick-off velocity of air-backed box-like structure after being struck by an incident shock-wave underwater, and the cavitation cut-off time, are also studied. The well-developed hydrocode LS-DYNA is used to study the structured dynamic response under the structure cavitation condition. Bleich and Sandler's problem about interaction between structures and bilinear fluids and Ramajeyathilagam and Vendhan's problem about deformation and rupture of thin rectangular plates subjected to underwater shock are adopted to verify the numerical results of the effect of the structure cavitation using LS-DYNA software. In addition, Sprague and Geers' ship-like structure subjected to an UNDEX is adopted to study the cavitation volume and structural responses. Results for studied problems obtained with the present implementation show close agreement with those obtained by the relevant literature and shows that the present works are very well.

Keywords : Underwater explosion、Cavitation、Structure cavitation

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