Numerical Simulation of Water Barrier Defense

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ABSTRACT

For warships, the ability to against the confrontation-ship missile attack in the battlefield is one of the important factors to survive. In 1995, the U.S. Navy surface combatants Center (NSWCDD) purposed a new method of defense water screen (water barrier defense), application of underwater explosions generated by the detonation of the affected fluctuation in the bubble at the surface. Due to pressure difference and detonation wave reflection, the bubble gradually lose the ball symmetry of shape, leading to the collapse of the bubble and formed a huge injection of the vertical column (water plume). This phenomenon used by the U.S Navy to develop the water barrier which is appropriate for the warships to create a proper distance from the water screen to block missile or missile debris to reduce the hull of the injury and become the last line of defense. Since the protective effect of the water screen is affected by the shape, width, and height of it, these factors are the current development of the water screen. Using MSC.Dytran nonlinear finite element analysis software, this paper took the defense ability of water barrier as an object. Fist, this paper took the capsule impacted water surface for an example of confirmation. The results of this paper using MSC.Dytran showed that the capsule's center of mass speed and acceleration are close to the data of the literature. While coupling , the element size near the collision point had an important impact on the accuracy of the calculation. The thinner the element, the more accurate the experiment data. Next, the study of the water barrier defense in this paper used the high-speed missile impacted water surface as the case study object to discuss whether the missile explode after impacted the water barrier with 90 degrees warhead cone angle. Furthermore, this paper discussed the change of displacement and speed while the missile passing through the water barrier. Finally, this paper provided a reference for the auteur analysis and design in water barrier.

Keywords : water barrier defense ; MSC.Dytran ; missile

Table of Contents

REFERENCES

[1] Cole, R. H., Underwater Explosions, Princeton University Press, Princeton (1948).

[2] Hollyer, R. S., " Direct shock-wave damage to merchant ships from noncontact underwater explosions ", J. SNAME, pp. 773-784 (1959).

[3] Keil, A. H., " The response of ships to underwater explosions", Annual Meeting of SNAME, New York (1961).

[4] George A. Young, " Guide-Line for evaluating the environmental effects of underwater explosion tests ", Explosion research department underwater explosion division naval ordnance laboratory, ODR-0332-004/092-1/UF 554-301, pp. NOLTR 72-211 (1973).

[5] Henrych, J., " The Dynamics of Explosion and Its Use ", Elsevier Sci. Pub. Co., Amsterdam, New York (1979).

[6] " " (2004) [7] "
" NSC-90-2623-7-212-005 2001

[8] " " (2006) [9] Gil Wittlin Mike Schultz Michael R.Smith," ROTARY WING AIRCRAFT WATER IMPACT TEST AND ANALYSES CORRELATION" Present at the American Helicopter Society 56th Annual Forum, Virginia, May 2-4(2000) [10] Edwin L. Fasanella and Karen E. Jackson , Chad E. Sparks and Ashish K. Sareen, " Water Impact Test and Simulation of a Composit Energy Absorbing Fuselage Section" ,Present at the American Helicopter Society 56th (2003)

[11] Hui Sun, Odd M. Faltinsen," Water impact horizontal circular cylinders and cylindrical shells" ,Applied Ocean Research (2006) [12]

"   "   (2000) [13]   "

"   (2006) [14]   "   "   [15]

"   "   (2001) [16]   "

"   (2001) [17]   "   "   (2004) [18]

"   "   (2006) [19] John. Wang and Karen H.lyle," Simulating Space Capsule Water Landing with Explicit Finite Element Method" ,American Institute of Aeromautics and Astronautice(2006) [20] MSC.Software   . MSC.Dytran User's Manual