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The prediction of plastic damage degree of stiffened cylindrical shell considering of hydrostatic pressure

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Plastic damage of submarine subjected to the heavy underwater weapon attacks will come out in different working depth, thus to study its damage degree has great importance to the submarine vitality. At present, in theory, Lellep[1] supposes the cylindrical shell to be a beam of which one end is clamped and the other one is simply supported to analyze the plastic response. Meanwhile in the respect of software simulation, ABAQUS and DYNA[2-3] have been used to simulate the interaction between the shock wave and the stiffened cylindrical shell in underwater explosion. But the hydrostatic pressure's effect on the plastic damage of the submarine structures have not been considered in these papers, so it is necessary to take it into consideration to simulate the real submarines' working conditions.

Firstly, because the bulkhead of the stiffened cylindrical shell is strong artifact, a tank of it is intercepted to do the dynamic analysis, and the boundary condition of the plastic damage dynamic model is that the both ends clamped, shown in Fig.1.

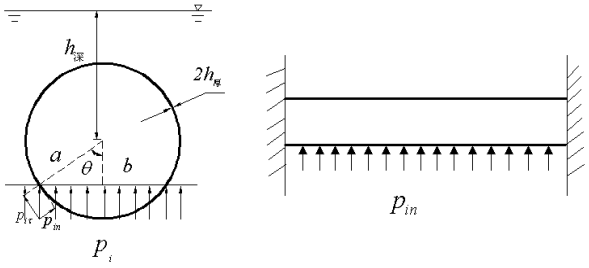

Fig.1 The calculation model of cylindrical shell

Secondly, due to the fact that the different dynamic response will come out when the pulse load and static load which have the same size do on the same system, a dynamic magnification coefficient will be obtained. In this paper, because the stiffened cylindrical shell is long enough, the hydrostatic pressure can be converted to the dynamic load which has the type of the rectangular pulse load on the cylindrical shell, by studying the dynamic amplification coefficient of a beam model of which the both ends is clamped.

Thirdly, the shock wave and the hydrostatic pressure both of which have been converted into the rectangular pulse load are used on the mechanical model, and the motion equation of a shell element is obtained, based on the dynamic rules. Then, the plastic deformation of a

cylindrical shell in different time at different location will be obtained combining with the yield conditions.

At last, the theoretical results are compared to the experimental results, shown in Tab.1 which verifies that the dynamic model can forecast the dynamic plastic damage degree of the stiffened cylindrical shell considering of the hydrostatic pressure in underwater explosion.

Tab.1 The contrast between the theoretical deflection value and the experimental one in the midpoint of the cylindrical shell

Condition （TNT(g)-Charge Distance(mm)-Depth(m)）	Theoretical value （mm）	Experimental value （mm）	Error
5-300-4.75	3.15	4	21.3%
5-150-4.75	8.34	10	16.6%
10-300-4.75	10.28	12	14.3%

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