ONLINE ISSN : 1881-1760
PRINT ISSN : 1880-3717

Journal of the Japan Society of Naval Architects and Ocean Engineers
Vol. 7 (2008) pp.223-231

The Buckling Strength of Initially Imperfect Shells under Various Stress Condition

Takao Yoshikawa[1)] and Michihiro Ishikawa[2)]

1) Kyusyu University, Faculty of Engineering, Department of Marine Systems Engineering
2) Tsuneishi Sipbuilding Company, Planing Division, Ship Planning Department

(Accepted November 27, 2007)

Summary: It is well known that the buckling strength of spherical shell and cylindrical shell is reduced by initial shape imperfections and the reduction rate is much influenced by stress conditions. This reduction rate will vary in accordance with the imperfection shape even for the same maximum magnitude. In this study, the geometrical non-linear FE analysis is performed in order to examine what kind of initial imperfection shape will most reduce the buckling strength of cylindrical shell, spherical shell, and ellipsoidal spherical shell under various stress conditions, such as one-directional compression, two-directional compressions, and combined one-directional compression and another directional tension. In the case of both-ends simply-supported cylindrical shells under axial compression, the axi-symmetrical shape imperfection, which is axially of the buckling mode, reduces the buckling strength more than any other imperfection shape with the same maximum magnitude. In contrast to this, cylindrical shells under lateral pressure or under external pressure (combined lateral and axial end pressure) , spherical shell under external pressure and in the partial filling condition that produces the meridian compressive and latitude tensional stress conditions just below the equator, and ellipsoidal spherical shell under the same loading condition as for spherical shell, the imperfection of asymmetrical buckling mode reduces the buckling strength more than any other imperfection shape. The buckling strength of cylindrical shell is much influenced by imperfection mode, while that of spherical and ellipsoidal spherical shells less influenced. In addition, the buckling strength of sandwich (laminated) shell structures with steal skin plate and foam core are examined. The sandwich shell structure is found to have a larger buckling strength and less imperfection sensibility than the homogeneous shell with the same weight.