

# Carrying Capacity of Pressure Vessels under Hydrostatic Pressure

Yang-chun DENG, Gang CHEN

## Summary

To use material effectively and keep pressure vessel safety, large deformation analysis for pressure vessel is very important. Until 2007, the elastic-plastic stress analysis method, that is the first time all over the world, is provided in ASME A.1-2 edition 2007 for boiler and pressure vessel standard that Finite Element Method is used with large deformation analysis. But there is no common recognized direct solution for the carrying capacity of pressure vessels yet and this restricts the application of large deformation analysis in pressure vessel design. This paper investigates the carrying capacity of pressure vessels under hydrostatic pressure, based on the elastic-plastic theory. Firstly, to understand the large deformation characteristic of pressure vessel, the expressions of pressure and strain of thin-walled cylindrical and spherical vessels under internal pressure are reviewed. Secondly, to investigate the solution of carrying capacity of pressure vessels, the plastic instability criterion is derived. Further, the method to obtain the carrying capacity of pressure vessels is given for all pressure vessel material and two representative examples for analysis solutions of cylindrical and spherical pressure vessel respectively are given. The proposed research can be used for the elastic-plastic stress analysis method of pressure vessels safely.

**Keywords:** pressure vessel, carrying capacity, large deformation, elastic-plastic

