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PARAMETER OPTIMIZATION OF THE TRANSITION ZONE OF LARGE THIN-WALLED TANK STRUCTURE

Abstract

When a large thin-walled tank structure is subjected to internal pressure, large local bending moment and stress gradient is formed in the transition zone between the cylinder shell and the semi-spherical shell. It is known that it is difficult to realize the constant strength design through the traditional method. Also, the topological optimization is relatively difficult due to the existence of internal pressure on the design region. In this paper, firstly finite element method is conducted to analyze the conventional design of the transition zone; it is discovered that there is a change of force transmission path from the inner wall to the outer wall, which produces a high stress gradient in the transition zone. Secondly, based on the concept of force transmission path control, two weakened zones are constructed respectively in the transition ring and the thick section of cylinder shell; then a parameter optimization model is formed. Finally, sub-model approach is introduced and Non-dominated Sorting Genetic Algorithm (NSGA) is adopted for the parameter optimization. Then, more uniform stress distribution of the welding zone is obtained, and the maximum stress value is decreased from 227.3 MPa to 137.5 MPa.