

Analysis of Residual Stresses and Angular Distortion in Stiffened Cylindrical Shell Fillet Welds Using Finite Element Method

Authors : M. R. Daneshgar, S. E. Habibi, E. Daneshgar, A. Daneshgar

Abstract : In this paper, a two-dimensional method is developed to simulate the fillet welds in a stiffened cylindrical shell, using finite element method. The stiffener material is aluminum 2519. The thermo-elasto-plastic analysis is used to analyze the thermo-mechanical behavior. Due to the high heat flux rate of the welding process, two uncouple thermal and mechanical analysis are carried out instead of performing a single couple thermo-mechanical simulation. In order to investigate the effects of the welding procedures, two different welding techniques are examined. The resulted residual stresses and distortions due to different welding procedures are obtained. Furthermore, this study employed the technique of element birth and death to simulate the weld filler variation with time in fillet welds. The obtained results are in good agreement with the published experimental and three-dimensional numerical simulation results. Therefore, the proposed 2D modeling technique can effectively give the corresponding results of 3D models. Furthermore, by inspection of the obtained residual hoop and transverse stresses and angular distortions, proper welding procedure is suggested.

Keywords : stiffened cylindrical shell, fillet welds, residual stress, angular distortion, finite element method

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