A rapid calculating method for the concentrated notch stress in thin-walled structures
for ICCM

*Yunfeng Shi ¦ †Rui Li[1], Bo Wang[1], and Bin Wang[2]

[1]State Key Laboratory of Structural Analysis for Industrial Equipment, Department of Engineering Mechanics, International Research Center for Computational Mechanics, Dalian University of Technology, Dalian, China
[2] Beijing Institute of Astronautical Systems Engineering, Beijing, China

*Presenting author: et8001@126.com
†Corresponding author: ruili@dlut.edu.cn

Abstract

The numerical analysis of a notched thin-walled structure is an extremely time-consuming process since a finer mesh is necessary for a more accurate stress calculation at the notch root. In order to obtain accurate concentrated stresses while reducing the element number, a new rapid calculating method is proposed for the notch stress by utilizing the adjacent axial stresses away from the notch. The explicit relationships between the adjacent axial stresses and notch-root stress in both the elastic and plastic stages are derived based on the bilinear constitutive relations and power exponential constitutive relation. A refined finite element modeling indicates that the developed rapid calculating method for concentrated stress is feasible for both two constitutive relations, and the result accuracy is satisfactory. The purposed method has the advantages of timesaving, easy implementation and independence of the boundary complexity such that it has potential for applicability in notched thin-walled structures' numerical analysis and optimization.

Keywords: notched structure, rapid calculating, mesh reduction, stress concentration factor