

ANALYTICAL APPROACH FOR LARGE SIZE REINFORCED SQUARE HOLE WITH ROUNDED CORNERS IN ORTHOTROPIC CIRCULAR CYLINDRICAL SHELLS

Pradeep Mohan
Associate Professor
Mar Baselios College of Engineering and
Technology
Thiruvananthapuram-695 015, India
Email : pradeep.m@mbcet.ac.in

R. Ramesh Kumar
Nodal Officer and Professor
Sree Chitra Thirunal College of Engineering
Thiruvananthapuram-695 018, India
Email : rameshkumar9446@gmail.com

S. Anil Lal
Professor
Department of Mechanical Engineering
College of Engineering Trivandrum
Trivandrum-695 016, India
Email : anillal65@gmail.com

Abstract

Full field tangential stress distribution in a uniaxially loaded composite circular cylindrical shell with various laminate sequences with reinforced square hole with rounded corners is achieved and good agreement is obtained with finite element results. Available solution for stress distribution in an infinite plate with square hole under axial load is suitably modified with unknown coefficients in the power series of hole shape parameter, e and curvature parameter, b (orthotropic plate solution + trigonometric terms as a function of $pb^2/2$). The reinforcement thickness for a desired target SCF value (preferably 50% reduction) and region of reinforcement over the shell surface w.r.t hole centre for any combination of hole size, shell thickness and radius are arrived at by an empirical relation based on numerical analysis. Solution for shell with reinforced square hole with $b \leq 0.25$ is arrived at by an iterative technique and further expressed and validated for large size reinforced holes for $b \leq 2.0$.

Keywords: Curvature Parameter, Fourier Series, Hole Shape Parameter, Stress Concentration Factor