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POINT SUPPORTED COMPOSITE STIFFENED SADDLE SHELLS WITH CUTOUTS: NATURAL FREQUENCY AND MODE SHAPES

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Abstract: *Natural frequency and mode shapes of laminated composite stiffened saddle shells with cutouts are determined employing the eight-noded curved quadratic isoparametric element for shell with a three noded beam element for stiffener formulation. Free vibration problem of stiffened saddle shells with different size and position of the cutouts with respect to the shell centre are examined to arrive at some conclusions useful to the designers. The results are further analyzed to suggest guidelines to select optimum size and position of the cutout with respect to shell centre.*

Keywords: *Composite stiffened saddle shell; cutout; natural frequency; mode shape, point support.*

INTRODUCTION

Dynamic analysis of shell structures having complex geometry, loading and boundary conditions can be solved efficiently by finite element method. Laminated composites are increasingly being used nowadays in aerospace, civil, marine and other related weight-sensitive engineering applications requiring high strength-to-weight and stiffness-to weight ratios. Among the different shell forms, saddle shells are one of them. Cutouts are provided in shell panels to save weight and also to provide a facility for inspection. In practice the margin of the cutouts are stiffened to take account of stress concentration effects. Also, there can be some instruments directly fixed on these panels, and the safety of these instruments can be dependent on the vibration characteristics of the panels. Hence free vibration studies on saddle shell panels with cutouts are of interest to structural engineers.

Different computational models for laminated composites were proposed by researchers. Chao and Tung (1989) presented an investigation on the dynamic