Application and analysis of porous-cellular structures

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Abstract: In the important development of material science, lightweight structures made of porous-cellular materials such as porous metal foam, are widely used in many applied sciences and applications such as in aerospace industry, automotive and civil engineering, etc. are known to have many interesting combinations of different properties such as high stiffness in conjunction with very low specific weight or high compression strengths combined with good energy absorption characteristics. The aim of this presentation is to show theanalysis and applications of porous-cellular plates and shells. In the porous-cellular structure model, porosities are dispersed by uniform and non-uniform (symmetric and asymmetric) distribution patterns. The first-order shear deformation theory and classical shell theory are used to derive the governing equations for plate and shell models. Finally, a comprehensive examination into the influence of porosity coefficient, porosity distributions, and the geometric parameters on the buckling behaviors and vibration response of the porous-cellular plates and shells are performed. Numerical results indicate that the effect of porosity distributions on the structural performance and provide the useful insights into the porosity design to achieve appropriately natural frequency and buckling resistance.

Keywords: Porous material; Plate;Shell;Buckling;Vibration