

# Analysis of Composite Truss-core Sandwich Panels for Thermal Protection Systems

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**Abstract:** A composite truss-core sandwich panel is investigated as a candidate for an Integral Thermal Protection System (ITPS). This new ITPS concept will protect the space vehicle from extreme reentry temperatures. The sandwich structure is idealized as an equivalent orthotropic thick plate continuum. The truss core is composed of two thin flat sheets that are separated by two inclined plates. The extensional stiffness matrix [A], coupling stiffness matrix [B], bending stiffness [D] and the transverse shear stiffness terms  $A_{44}$  and  $A_{55}$  are calculated by analyzing the unit cell. Using the Shear Deformable Plate Theory (SDPT) a closed form solution of the plate response was derived. The behavior of the stiffness and maximum plate deflection due to changing the web angle inclination is discussed. The calculated results, agree well with the 3D finite-element analysis. The study indicates that panels with rectangular webs resulted in a weak extensional, bending, and  $A_{55}$  stiffness and that maximum plate deflection was greatest for  $50^\circ$  web angle configuration. The analysis procedures developed in this study is to determine the unit cell stresses for each component of the truss (face or web) that is caused by a uniform pressure.