

**Title :** Structural Stability of Functionally Graded Panels under Aero-thermal Condition

**Abstract :** Functionally Graded Materials (FGMs) are advanced composite materials in which the material composition varies smoothly and continuously over the volume so that material properties also change gradually. The main applications of functionally graded materials are in high temperature environments and typical form of FGMs composed of ceramic and metal are developed as high-heat-resistant materials. Especially, FG panels made of ceramic and metal are used for skins of spacecrafts which are subjected to high aerodynamic pressure and tremendous temperature changes caused by aerodynamic heating during the re-entry status. In this paper, static and dynamic stabilities of functionally graded (FG) panels that are subjected to simultaneous condition of thermal and aerodynamic load are investigated in this paper. The volume fractions of each constituent material in the FG panels are assumed to be given by a simple power-law distribution. Material properties of the FG panels are obtained by a linear rule of mixtures. A rectangular plate that is based on the first order shear deformation theory (FSDT) is used as a model of the FG panels. The von Karman strain-displacement relation is used to account for the geometric nonlinearity which is caused by a large deformation. The first order piston theory is adopted to present supersonic aerodynamic load acting on the panels. Governing equations are derived by the principle of virtual work and the numerical solutions are obtained by using a finite element method. The Newton-Raphson method is applied to get numerical solutions of nonlinear equations. Flutter boundaries are defined by eigenvalue analyses and the Guyan reduction is applied to reduce the degree of freedom. The influence of the material constitution and asymmetric characteristics of FG panels on critical conditions for thermal buckling and flutter are examined. Static and dynamic stability margins of FG panels are defined for various volume fractions for various boundary conditions and volume fractions.

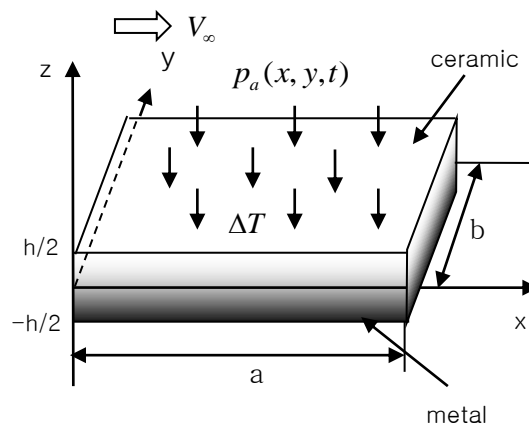


Figure 1. Functionally graded panel in supersonic flow under thermal effect