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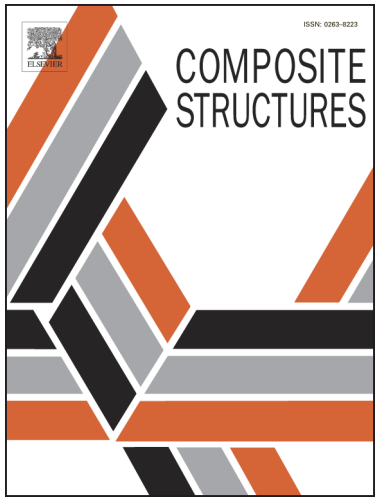

Dynamic Buckling of Suddenly Heated or Compressed FGM Beams Resting on Non-linear Elastic Foundation

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Dynamic Buckling of Suddenly Heated or Compressed FGM Beams Resting on Non-linear Elastic Foundation

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Abstract

In this paper, static and dynamic buckling of an FGM beam subjected to uniform temperature rise loading and uniform compression are studied. Material properties of the beam are assumed to be graded across the thickness. Each thermo-mechanical property of the beam is assumed to be temperature dependent. Initial imperfection of the beam is also taken into account. The beam is resting over a three-parameter elastic foundation with hardening/softening cubic nonlinearity which acts in tension as well as in compression. Nonlinear governing equations are obtained based on the static version of virtual displacements and are solved via the multi-term Galerkin method. Dynamic buckling load levels are estimated based on the well-known Hoff-Simitses criterion. Results reveal that for sufficiently stiff softening elastic foundation, post-buckling equilibrium path becomes unstable. Furthermore, when the thermal post-buckling equilibrium path is stable, no dynamic buckling occurs according to this criterion.

Keywords: Nonlinear Elastic Foundation, Temperature Dependent, Thermal Buckling, Post-buckling, Dynamic Buckling, Galerkin Method, Hoff-Simitses Criterion

1 Introduction

Functionally graded materials (FGMs) are known as a class of novel materials which are generally comprised of different constituents. Structures made of FGMs are typically used in high thermal environment. Therefore, studying the static or dynamic thermal stability of structures made of FGMs is a main step for design purposes.

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