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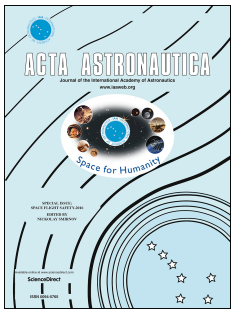

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Investigations on the influences of elastic foundations on the aerothermoelastic flutter and thermal buckling properties of lattice sandwich panels in supersonic airflow

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Abstract

The lattice sandwich panels supported on elastic mediums are often applied in the construction of aerospace structures because of the low specific weight, excellent bending rigidity and outstanding vibration properties. This elastic medium can be any spring materials including damping tapes or heat shields which are attached to one side of the sandwich panel. Therefore, in this paper, aerothermoelastic flutter and thermal buckling characteristics of sandwich panels with the pyramidal lattice core resting on elastic foundations in supersonic airflow are studied. The influences of geometrical parameters and elastic foundation on the panel flutter and thermal buckling of the structures are analyzed in details. In the structural modeling, the first-order shear deformation theory is applied, and the effective material properties of the lattice core are used. The aerodynamic pressure is evaluated by the supersonic piston theory. Hamilton's principle and the assumed modes method are applied to formulate the equation of motion. The highlight point of this investigation is that an effective thermal buckling suppression method utilizing the elastic foundation is proposed, based on which the thermal buckling of the structure can be completely eliminated with the natural frequencies remaining unchanged when the shearing layer parameter is equal to the thermal load. Through the numerical results, the influences of the elastic foundation, aspect ratio, core-to-facesheet thickness ratio, and inclination angle of the core truss on the aerothermoelastic behaviors of the lattice sandwich panel are analyzed, and the thermal buckling elimination effects are also examined.

Keywords: sandwich panel; pyramidal lattice core; elastic foundation; thermal buckling elimination; supersonic airflow; aerothermoelastic analysis.

1 Introduction

Lightweight lattice sandwich structures are extensively used in aerospace field due to their high strength, excellent bending rigidity, heat insulation and outstanding noise reduction properties. The

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