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Thermoelastic Analysis of Functionally Graded Materials Submitted to Shocks

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Thermal protection systems using advanced materials are used to attenuate damage on the basic structure due the stress waves propagation as a consequence of thermal shocks. This is typically find on re-entry motion of space vehicles. Ceramic materials have been used due to their capacity of thermal isolation and to their low specific weight. The utilization of Functionally Graded Materials (FGM) enhances the quality of the thermal protection as they tend to avoid stress concentration on the interfaces if they combine ceramics and the basic material that constitutes the structure to be protected. The present work presents a numerical formulation to solve the strongly coupled thermomechanical problem submitted to thermal shock like solicitations. An staggered algorithm without upsetting the unconditional stability property characteristic of fully implicit schemes is used. Numerical simulations are presented for an FGM bar submitted to an abrupt variation of external temperature representing thermal shocks.

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