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Strength Evaluation of Functionally Graded Materials Under Severe Thermal Environments

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Thermal shock strengths of a plate of a functionally graded material are analyzed when the plate is suddenly exposed to an environmental medium of different temperature. A Finite Element/Mode Superposition (FE/MS) method is proposed to solve the time dependent temperature field. The admissible temperature jump that the material can sustain is studied using the stress-based and fracture mechanics-based criteria. The critical parameters governing the level of the transient thermal stress in the medium are identified. Thermal shock resistances of the functionally graded materials under transient thermal stresses are analyzed using both the maximum local tensile stress criterion and the maximum stress intensity factor criterion.

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