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Optimum Control of Thermoelastic Deformation in a Smart Composite Disk

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This paper deals with a smart composite circular disk that controls a thermoelastic deformation resulting from an unknown thermal load. The disk consists of a transversely isotropic structural layer onto which two piezoceramic layers are bonded. An unknown heating temperature distribution acting on the structural layer surface is inferred from the induced electric potential distribution assumed to be measured in the middle piezoceramic layer. Then a step-wise electric potential distribution is applied to electrodes concentrically arranged on the top piezoceramic layer, in order to control the thermoelastic displacement distribution on the structural layer surface. This problem is analyzed using a potential function approach. The voltage applied to each electrode is determined by optimization so that the difference between the induced and desired displacement distributions is minimized subject to stress constraints. Numerical results are presented in graphical and tabular form.

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