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Shape Optimization of Thermomechanical Structures in the Presence of Convection and Radiation Using Parallel Evolutionary Computation

Ryszard A. Białecki[(1)], **Tadeusz S. Burczyński**[(2)], Adam Długosz[(2)], Wacław Kuś[(2)], Ziemowit Ostrowski[(1)]

(1) *Institute of Thermal Technology, Silesian University of Technology, Gliwice, Poland*
(2) *Department for Strength of Materials and Computational Mechanics, Gliwice, Poland*

Shape optimization of heat conducting, elastic bodies subjected to thermal and standard loads is considered. Interaction of stress and temperature fields is modeled using the formulation of steady state thermoelasticity. The presence of heat radiation with mutual irradiation of the boundaries and the presence of shadow zones is taken into account. A parallel evolutionary algorithm is used to evaluate the optimal shape. The boundary element method is applied to discretize the thermoelasticity, conduction and radiation problems. Numerical tests for the problem of optimal shape of a heat radiation used to dissipate heat from electrical devices are presented. Two criteria of optimization are applied: (i) minimum volume of the entire domain with constraints imposed on maximum admissible temperature and equivalent stress fields and (ii) maximum amount of heat dissipated from a portion of the boundary with the constraint imposed on maximum volume of the structure.

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