

BEM Analysis of Actively Cooled Thermal structures

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Abstract

This paper utilizes the boundary element method to perform the analysis of temperature, displacement and stress fields for the active cooling channel structures. First, the algorithm of using boundary element method to solve convective heat transfer problems in cooling channels is proposed, and then the thermal and mechanical analysis are performed for a combustion chamber with cooling channels. The main feature of the paper is that the domain integrals appearing in the convective heat transfer boundary integral equations are transformed into equivalent boundary integrals and, as a result, internal cells are not required in computation. This is convenient to model complicated thermal structures. The method proposed in this paper can be used to investigate the behavior of actively cooled thermal protection systems for the engine of hypersonic aircrafts.

Key words: Boundary element method; active cooling channel; thermal protection system; convective heat transfer