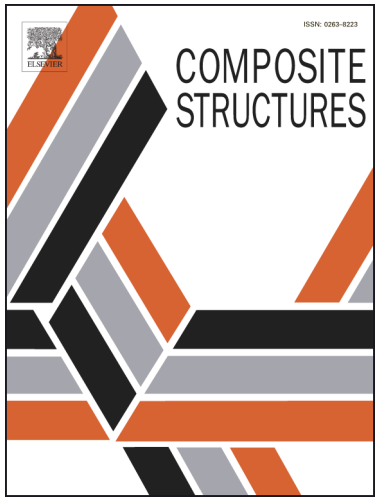

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Exact analytical solution for steady-state heat transfer in functionally graded sandwich slabs with convective-radiative boundary conditions

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Abstract

A study was conducted to derive an exact analytical solution for steady-state heat transfer in functionally graded (FG) sandwich slabs with convective-radiative boundary conditions. The dimensionless governing equations and boundary conditions in the form of a quartic equation were derived and the solution based on Ferrari's method was achieved. The temperature field of FG sandwich slabs was calculated by finding the roots of the quartic equation. The results obtained by using the exact analytical solution have been successfully verified against those obtained by using the existing approximate analytical solutions for a homogeneous rectangular slab. In addition, the effects of geometrical and physical parameters, such as Biot number, facesheet thickness, environment temperature ratio, radiation conduction and thermal conductivity, on the heat transfer performance have been analyzed.

Keywords: Sandwich; Functionally graded materials; Analytical solution; Heat transfer.

1. Introduction

Functionally graded materials (FGMs) are composite materials formed of two or more constituent phases with a continuously variable composition. Recently, FGMs