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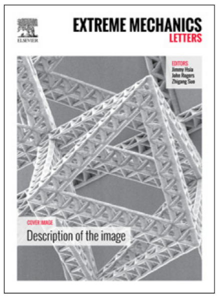

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Optimum Analytical Design of Medical Heat Sink with Convex parabolic Fin Including Variable Thermal Conductivity and Mass Transfer

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Abstract

Electronic medical devices have become more powerful in recent years. These medical devices contain arrays of electronic components, which required high-performance heat sinks to prevent from overheating and damaging. For the design of high-performance medical heat sinks, the temperature distribution should be evaluated. Thus, in this paper, the Generalized Differential Transformation Method (GDTM) is applied to the medical heat sink with a convex parabolic convective fin with variable thermal conductivity and mass transfer. In the first section of the current paper, the general heat balance equation related to the medical heat sink with convex parabolic fins is derived. Because of the fractional type of derivative, the concept of GDTM is employed to derive analytical solutions. The major aim of this study, which is exclusive for this article, is to find the closed-form analytical solution for the fractional differential equation in considered heat sink for the first time. In the next step, multiobjective optimization of the considerable fin is performed for minimum volume and maximum thermal efficiency. For evaluation of optimum design at various environmental conditions, the multi-objective optimizations are performed for a wide range of environmental conditions. In the final step, the results of multiobjective optimization in various environmental conditions are applied to the genetic programming tool and suitable analytical correlations are created for optimum geometrical design.

Keywords: Medical heat sink, Convex Parabolic, Variable thermal conductivity, fractional, Generalizes Differential Transformation Method (GDTM)

1. Introduction

Electronic medical devices have become more sophisticated and powerful in recent years. These systems contain large arrays of power consuming electronic components and thus the temperature is increased continuously. It is required; the high-performance heat sinks to prevent medical devices

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