عنوان مقاله:

Thermal Performance of Convective-Radiative Transfer Longitudinal Moving Rod with Variable Thermal Conductivity

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خلاصه مقاله:

An analysis has been performed to study the problem of the thermal performance of a continuously moving convective-radiative rod with variable thermal conductivity. Highly accurate semi-analytical methods called the least Square method (LSM) and the Galerkin method (GM) are introduced and then used to obtain a nonlinear temperature distribution equation in a fin that allows for more accurate measurements that could make the investigation stand out. This research investigated the influence of various parameters on heat transfer in a continuously moving convective-radiative rod. The parameters examined include the convective-conductive factor (Ncc), dimensionless thermal conductivity coefficients (a), radiative-conductive parameter (Nrc), Peclet number (Pe), dimensionless convective (θc), and radiative sink temperatures (θr). An increase in the dimensionless thermal conductivity coefficient (a) led to higher dimensionless temperatures within the rod, indicating an amplification of conductive heat transfer. The convective-conductive parameter (Ncc) demonstrated a direct relationship with heat loss. In contrast, the radiative-conductive parameter (Nrc) exhibited an inverse relationship between radiative heat transfer and local temperature within the fin. A rise in the Peclet number was associated with higher dimensionless temperatures, indicating a faster-moving rod. Additionally, variations in dimensionless convective and radiative sink temperatures affected temperature profiles, with higher sink temperatures resulting in increased dimensionless temperatures. Notably, the dimensionless radiative sink temperature was found to have a more significant impact on overall dimensionless temperature than the convective sink temperature. These findings underscore the intricate interplay of factors governing heat transfer and temperature distribution in the moving rod system. The importance of this work lies in its comprehensive analysis of the intricate interplay of parameters affecting heat transfer and temperature distribution in continuously moving convective-radiative rods, providing valuable insights for optimizing industrial processes and engineering applications.

کلمات کلیدی:

(Moving convective-radiative rod, Temperature-dependent thermal conductivity, Least Square method (LSM), Galerkin method (GM