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Patent Search

Invention Title	THE DYNAMICS OF HEAT WITH DIFFERENTIAL EQUATIONS MODELS FOR PREDICTING TEMPERATURE DISTRIBUTION IN COMPLEX SYSTEMS
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Abstract:

Abstract The presented research contributes to the development and validation of a differential equation model that comprehensively describes temperature distribution challenging multi-material systems. We used several advanced numerical methods, such as the Finite Element Method and Finite Volume Method, to account for conducti convection, and radiation, then integrated and simulated these interactions within a single model framework. It is tested and validated the model using experimental data multi-material system that included polymers, metals, and other relevant distinguishable materials. Temporary results indicated that, on average, the model deviated from measurements by approximately ±2 °C observed 24 hours a day for a high level of environmental realism. Moreover, the experimentally implemented model validated the flux prediction in four critical locations, showing a deviation from -5 to +3 arbitrary units, thereby reinforcing the above statement. Finally, the presented error analysis of t model's predictions demonstrated the least developed regression residual, which is less than 10% of the observed values. Therefore, the model's benefits extend beyond i original understanding, potentially aiding engineers and designers in the development of optimal thermal management solutions.

Complete Specification

Description:The Dynamics of Heat with Differential Equations Models for Predicting Temperature Distribution in Complex Systems

Field and Background of the Invention

Many disciplines with complex systems use temperature modelling as an essential tool. This includes engineering, environmental science, and technology fields. In these and many other related fields, optimal distribution and the ability to predict temperature play a huge role, affecting the output of mechanical systems, ecosystem stabilit and the efficiency of technological devices. Mechanical engineers revaluate novel systems such as reactors, heat exchangers, and electronic components that allow for precise thermal management issues. For instance, the design of high-power electronic components and heat management pipes requires significant knowledge.
Environmental studies play a crucial role in facilitating climate impact assessments and conducting heat pollution assessments of resources. In high-level technology, wit the correlation systems of data centres and integrated circuits, heat management can enhance reliability by several percent. This research primarily addresses the questi "How can we optimize differential equations to enhance the accuracy of temperature distribution models in complex multi-material systems that are system-specific?" Th conditions define the connection with the problem: the existing models are often unable to provide an appropriate level of accurate reflection of the non-linear nature o the state dynamics. The specific character of real-life system materials contributes to this factor. Indeed, a change in specific qualities can make the materials dependent temperature, potentially multiplying the interaction of different telegram transfer mechanisms.
The goal of this study is to create and deeply validate a differential equation model that can accurately and feasibly simulate temperature changes in highly complex systems. In particular, the model must be multi-component and non-static, work well for multiple materials, and be relevant for different scales and operational conditio

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