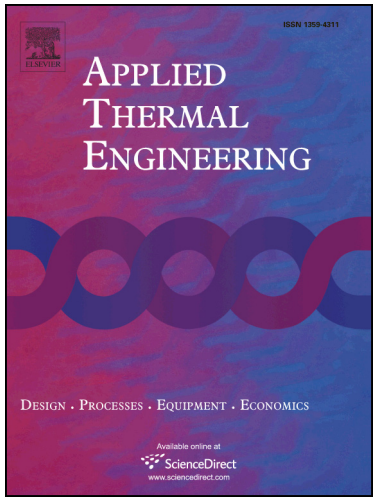

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Performance of a thermoelectric cooling system integrated with a gravity-assisted heat pipe for cooling electronics

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Abstract

Heat generated by electronic devices in small spaces is significant and continues to increase as more of these devices are brought into the work place as software and internet technologies are developed. Therefore, thermal management of electronic devices is crucial to avoid malfunction and failure of critical hardware as a result of overheating. To regulate heat buildup within electronic devices, a thermoelectric cooling (TEC) system coupled with a gravity-assisted heat pipe is proposed in this paper. A mathematical model of the heat transfer, based on energy conservation equations, was developed to analyze the system. A prototype system was designed, built, and tested as part of this work. The testing took place in a climatic chamber where various ambient conditions were simulated. The cooling capacity of the proposed system when several working fluid filling masses were used was monitored for different cooling demands. The results showed that the cooling capacity was improved by 64.8% and the electricity consumption was reduced by 39.3% for similar conditions when the proposed system was compared to a TEC system with an air cooling heat sink.

Keywords: thermoelectric cooling (TEC); gravity assisted heat pipe (GAHP); electronic device cooling