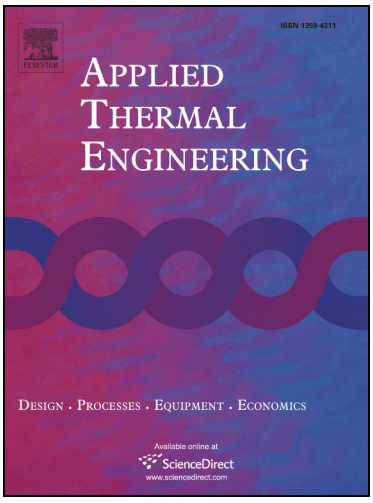

Research Paper

Development of a numerical method for the performance analysis of thermo-electric generators with thermal and electric contact resistance

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Development of a numerical method for the performance analysis of thermoelectric generators with thermal and electric contact resistance

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Abstract

Lately, the development of thermoelectric (TE) materials with higher ZT values allows the fabrication of thermoelectric devices with higher performance. Though several analytic analyses of the effect of contact resistance on the thermoelectricity have been reported, the numerical prediction of a thermo-electric generator (TEG) with finite thermal and electric contact resistance has been rarely studied. In the present study, based on the conservation principle of the thermal energy and electric charge, newly devised is a numerical modeling for the performance evaluation of a TEG with thermal and electric contact resistance and without any simplification (or neglect) of Joule heating, Thomson heating and Peltier heating, with the use of temperature-dependent thermoelectric properties, which allows accurate solutions, and built is a computer program for the performance simulation. Here, investigated is the effect of pellet length on the TEG performance in the presence of thermal and electric contact resistances. The present numerical modeling and the computer program adopting a new numerical solution method is validated against a mathematic result. Also, the obtained performance of the TEG is compared with that acquired by an existing analytic model. In the present study, as an evaluation factor of a TEG performance, the effectiveness (meaning the ratio of the performance of a TEG with resistances to that without any resistance) is newly