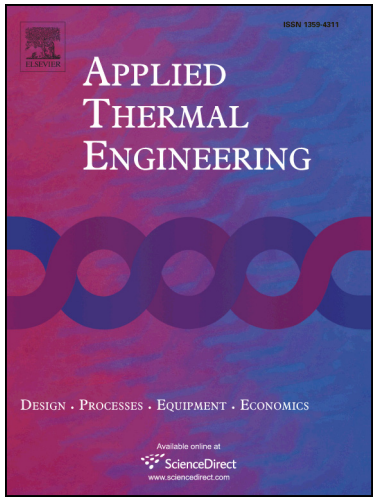

Computational model and optimisation of a vacuum diode thermionic generator for application in concentrating solar thermal power

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Title

Computational model and optimisation of a vacuum diode thermionic generator for application in concentrating solar thermal power

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Abstract

A complete model of a thermionic generator has been developed in order to optimise the technology for application in the solar thermal generation of electricity. Steady state current densities predicted by the model have been shown to agree with published experimental thermionic data. Two separate genetic algorithm optimisations have been carried out for both power density and efficiency, in which electrode temperatures and work functions, external circuit resistance and electrode separation were varied. The result of these optimisations were two configurations separately exhibiting a maximum power density of 1.66W/cm^2, and a maximum efficiency of 7.69% for parameter ranges applicable to concentrating solar thermal power. Examination of the optimum simulation parameters indicated that future developments in lowering collector work functions, increasing emitter service temperature and decreasing attainable electrode separations will all positively impact device performance.

Keywords

genetic algorithm; thermionics; energy conversion; optimisation; plasmas; concentrating solar thermal