Public Abstract

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Interest in thermoelectric for waste heat recovery has flourished in recent years. Thermoelectric has advantages such as simple structure, long service time, little maintenance and quiet operation. It can play an important role in saving energy and reducing the consumption of fossil fuel. Typically, the efficiency of thermoelectric generators (TEGs) is quite low. Investigations are carried out to get better performance. If an efficient technique to generate electricity from heat energy is obtained, the cost of thermoelectric would be greatly reduced.

This thesis presents the simulation model of a TEG with eight pairs of segmented legs. The technique of segmented legs is a promising method to increase TEGs' efficiency. The simulation model is firstly built with exactly the same materials and the same size as a physical existing TEG. Then the simulation model is compared with the prototype physical model to testify the accuracy of the simulation. The error between them is around 10% which is acceptable. After achieving the model of a segmented TEG, several methods are explored to improve its output power and conversion efficiency by simulation. Those methods include raising the working temperature, replacing the pellet materials and rebuilding the TEG geometry. It was found that the original model has much potential to be further improved. After optimization, output power increases from 188.2mW to 354.7mW, 703.13mW, 212.85mW respectively. Conversion efficiency increases from 1.66% to 2.08%, 7.03%, 1.85% respectively. Finally, a general way to design a segmented TEG is summed up, using all knowledge mentioned above.