

# Modeling, simulation analysis, and application of thermoelectric modules

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## ABSTRACT

This thesis presents the model implementations and verification of both thermoelectric cooler (TEC) and thermoelectric generator modules using Matlab/Simulink software package. They can be applied to electric vehicle air-conditioning systems by using waste heat recovery as power. When vehicle runs, high temperature waste heat will be emitted by the engine. By using thermoelectric generator (TEG), waste heat can be exchanged to DC. Combining the design of Maximum power point tracking (MPPT) can capture the biggest output power to recharge the battery of vehicles. It provides TEC that required by the cold room. At the same time, it can provide the electric power that required by vehicles. Both TEG and TEC are thermoelectric modules which are made of semiconductor solid-state device. The energy exchange processes of TEG and TEC are quiet and emission-free. It has some advantages of silence, zero-emission of greenhouse gas, long lifespan and clean energy. When the vehicle is running, the engine will put the waste heat out. Using TEG helps waste heat turn into DC. This electric power could provide the air-conditioning for the operation of the TEG and fan of cooling room. In this way, the oil expensing of vehicles will not be increased when using the vehicle air-conditioning systems.

Keywords : thermoelectric generator, thermoelectric cooler, thermoelectric module, Matlab/Simulink

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