Design of segmented thermoelectric Peltier coolers by topology optimization

A density-based topology optimization approach is used to optimize the cooling power and efficiency (coefficient of performance) of thermoelectric coolers by spatially distributing two different thermoelectric materials in a two dimensional design space. With basis in three numerical examples we identify important model parameters, such as the choice of objective function, the temperatures of the thermal reservoirs, the heat transfer rates and the available electrical energy. By using the topology optimization approach, we demonstrate that the cooling power and efficiency of thermoelectric coolers can be improved by 48.7% and 11.4%, respectively, compared to optimization results from in the literature.