Public Abstract
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Comprehensive Optimization for Thermoelectric Refrigeration Devices
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R. E. Smalley, 1996 recipient of the Nobel Prize in chemistry, stated that energy is the number one problem facing humanity for the next 50 years [Smalley, 1996]. If this projection comes to fruition, as it most probably will, proper implementation of technologies that generate and convert energy will be of immense importance. A large market is currently in place for which thermoelectric (TE) technology can provide diverse energy solutions. This market should continue to grow as improvements are made to TE materials. In the last 10-15 years, researchers have developed TE materials that promise to double the current performance of currently available materials. The semi-conductor industry and an enormous amount of study are fueling this improvement. The current study is directed to develop and analyze system level optimization schemes that make the best use of those new materials, in addition to currently available materials. Optimization will be conducted in two stages. The first method is to optimize the operating current, while the second stage is optimization with respect to material geometry, both are done numerically. The optimization results are also given analytically. Finally, the operation current optimization is then validated experimentally.

Smalley, R.E., Nobel Laureate 1996, “Our Energy Challenge,” Columbia University, NYC, September, 2003.