MAXIMUM ATTAINABLE PERFORMANCE OF STIRLING ENGINES AND REFRIGERATORS

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ABSTRACT

The flow through the regenerator of a Stirling engine is driven by differences of pressure in the compression and expansion spaces. These differences lead to power dissipation in the regenerator. Using linearized theory, it is shown that this dissipation severely limits the maximum attainable thermal efficiency and nondimensional power output. The maximum attainable values are independent of the value of the regenerator conductance. For optimized nondimensional power output, the thermal efficiency equals only half the Carnot value. The power dissipated in the regenerator is removed as part of the heat withdrawn at the regenerator's cold side. Analogous results are presented for the Stirling refrigerator. At optimized nondimensional rate of refrigeration, its coefficient of performance is less than half the Carnot value.

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