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Simple optimized heat engine: exploring thermodynamic behavior of finite-time quantities in the negative absolute temperature region of two-state spin systems[1] TOLASA ADUGNA DIMA, MULUGETA BEKELE OGATO, None — A model heat engine which operates between two reservoirs at inverse negative absolute temperatures is investigated. As the working substances of the engine, a system of two-level spin-half particles, in the thermodynamic limit, subjected to a time-dependent external magnetic field is used. We derive analytically the expressions for the net work done, net heat absorbed and the efficiency in terms of the occupation probability in the excited state and inverse negative temperature. The quaistatic efficiency is found to coincide with the Carnot efficiency of the model.In the finite-time process, the expressions for the power, efficiency and period are derived. An optimum working condition for the heat engine is also sought by employing a unified criterion for energy converters. Accordingly, the model engine is effectively optimized and yields optimum finite-time quantities. To estimate the overall performance of the engine we propose a figure of merit as a product of scaled optimized power and scaled optimized efficiency where the scaled optimized power is the ratio of optimized power to the maximum power and the scaled optimized efficiency is the ratio of the optimized efficiency to efficiency at the maximum power. We found the figure of merit in the model to be around 1.1.

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