[Talk 12] Efficiency at the maximum power output for simple two-level heat engine

Sang Hoon Lee , KIAS

We introduce a simple two-level heat engine to study the efficiency in the condition of the maximum power output, depending on the energy levels from which the net work is extracted. In contrast to the quasi-statically operated Carnot engine whose efficiency reaches the theoretical maximum, recent research on more realistic engines operated in finite time has revealed other classes of efficiency such as the Curzon-Ahlborn efficiency maximizing the power output. We investigate yet another side with our heat engine model, which involves the population difference caused by different transition rates. Due to the nature of our model, the explicitly time-dependent part is completely decoupled from the other terms in the generated work and the efficiency is independent of the operating time, which allows us to analyze the dependence on other system variables that are the transition rates, or implicit time dependence in this case. We provide the optimal combination of transition rates maximizing the generated power output and discuss its implication on general premise of realistic heat engines. In particular, we prove that the engine efficiency of our model for maximum power output is clearly different from the Curzon-Ahlborn efficiency in spite of its endoreversibility (possibly because of the nonlinear heat conduction), although they share the universal linear and quadratic coefficients at the near-equilibrium limit with similar values of transition rates.