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A Multi-Objective Optimization Tool for Dual-Mode Operating Active Magnetic Regenerator Model

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Abstract : This paper proposes an efficient optimization tool for an active magnetic regenerator (AMR) model, operating in two modes: magnetic refrigeration system (MRS) and thermo-magnetic generator (TMG). The aim of this optimizer is to improve the design of the AMR by applying a multi-physics multi-scales numerical model as a core of evaluation functions to achieve industrial requirements for refrigeration and energy conservation systems. Based on the multi-objective non-dominated sorting genetic algorithm 3 (NSGA3), it maximizes four different objectives: efficiency and power density for MRS and TMG. The main contribution of this work is in the simultaneously application of a CPU-parallel NSGA3 version to the AMR model in both modes for studying impact of control and design parameters on the performance. The parametric study of the optimization results are presented. The main conclusion is that the common (for TMG and MRS modes) optimal parameters can be found by the proposed tool.

Keywords : ecological refrigeration systems, active magnetic regenerator, thermo-magnetic generator, multi-objective evolutionary optimization, industrial optimization problem, real-world application
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