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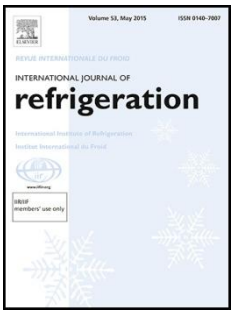

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SENSITIVITY ANALYSIS AND MULTIOBJECTIVE OPTIMIZATION OF A PARALLEL-PLATE ACTIVE MAGNETIC REGENERATOR USING A GENETIC ALGORITHM

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Highlights

- An advanced 1D numerical model of a parallel-plate AMRR has been developed.
- The influence of the fluid and solid layer thicknesses has been considered.
- The performances of various coolant fluids have been investigated.
- A parallel-plate AMRR has been optimized using a genetic algorithm.

Abstract

This paper analyzes the energetic and exergetic performance of an active magnetic regenerative refrigerator. A 1D numerical model has been developed to simulate a system composed of a parallel-plate regenerator, magnetic source, pump, heat exchangers and control valves. The effects of several parameters like the mass flowrate and the plate and fluid thicknesses are studied. Various types of refrigerants are tested thanks to the CoolProp library, accounting for temperature-dependent properties. A multiobjective optimization based on a genetic algorithm is used to enhance the system performance regarding the Pareto efficiency. Parameters like mutation and crossover fraction are considered in order to determine the optimal results in a fair computational time. The main goals are to maximize the coefficient of performance, the exergetic efficiency, and the cooling power while respecting precise constraints. The best tuning leads to a solution 9 times faster than mapping all possibilities using a rough grid size.

Keywords: Magnetic refrigeration, Parallel-plate regenerator, Gadolinium, Multiobjective optimization, Genetic algorithm.