066

NUMERICAL ANALYSIS OF NANOFLUID AS HEAT TRANSFER FLUID IN MULTIPLATES TYPE RECIPROCATE MAGNETIC REFRIGERATION SYSTEM

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ABSTRACT This study proposes a two-dimensional, mathematical model of Active Magnetic Regenerator (AMR) system at room temperature. 2D numerical model of a regenerative active magnetic refrigerator has been developed for predicting the thermal performances of a reciprocating AMR device using commercial CFD software CFD-ACE+. The transient energy equations for the heat transfer between magnetic refrigerant and circulating fluid throughout the gadolinium regenerator multi-plates are considered. Simulation results include the process and cooling capacity of three AMR model cycles with different cycle frequencies. Furthermore, the application of water based nanofluids is proposed, which enhances the cooling capacity significantly. This study provides three AMR cycles and CuO nanoparticles for evaluating cooling capacity. Results reveal that application of water based nanofluid with 6% volume fraction CuO leads to an increase of cooling capacity by a factor of 15% higher than that of the pure water. The cooling capacity can be improved by increasing the magnetization time in the cycle.