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A time-dependent, two-dimensional mathematical model of a reciprocating Active Magnetic Regenerator (AMR) operating at room-temperature has been developed. The model geometry comprises a regenerator made of parallel plates separated by channels of a heat transfer fluid and a hot as well as a cold heat exchanger. The model simulates the different steps of the AMR refrigeration cycle and evaluates the performance in terms of refrigeration capacity and temperature span between the two heat exchangers. The model was used to perform an analysis of an AMR with a regenerator made of gadolinium and water as the heat transfer fluid. The results show that the AMR is able to obtain a no-load temperature span of 10.9 K in a 1 T magnetic field with a corresponding work input of 93.0 kJ m⁻³ of gadolinium per cycle. The model shows significant temperature differences between the regenerator and the heat transfer fluid during the AMR cycle. This indicates that it is necessary to use two-dimensional models when a parallel-plate regenerator geometry is used.

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