Modelling and simulation of regenerators with complex flow arrangements for active magnetocaloric refrigeration

Compared to a conventional vapor compression refrigeration system, a magnetocaloric refrigerator has many advantages, such as potentially high efficiency, low vibration and avoidance of refrigerants that deplete the ozone layer and cause the greenhouse effect. As a main component of the active magnetic regenerative refrigerator, the regenerator plays an important role in the cooling performance and efficiency of the whole system. However, the regenerator design is constrained by several external factors, such as the geometry of the magnetic field source and flow resistance.

In this work, novel regenerators with complex flow arrangements, providing high performance at lower pressure drop, are investigated. Correspondingly a one dimensional model is presented and comparative studies between novel and conventional regenerators are carried out by simulation. The effect of regenerator geometries and different flow arrangements on the cooling performance, pressure drop and efficiency are investigated. In particular, the effect of so-called dead volume on the performance of a regenerator is researched.