Experimental investigation of different fluid flow profiles in a rotary multi-bed active magnetic regenerator device

A rotary multi-bed active magnetic regenerator (AMR) device was modified to allow testing different fluid flow waveforms, with different blow fractions (i.e. the fraction of the AMR cycle when there is fluid flow in the regenerators). The different values of blow fraction were generated using different cam rings that actuate the poppet valves at the inlet and outlet of the regenerators, controlling how long the valves stay open and the number of valves open at the same time. Results showed that smaller blow fractions yield higher values of temperature span for fixed flow rate and cooling capacity, but lower values of coefficient of performance for the same conditions. An analysis of the shaft and pumping powers showed that shorter blow fractions cause higher pressure drop and higher torque oscillations and mechanical vibrations. The highest value of second-law efficiency of 19.1% was obtained for the largest blow fraction tested (80%). Designs for magnetic refrigerators where the fluid flow waveform can change during operation are also discussed in this paper.