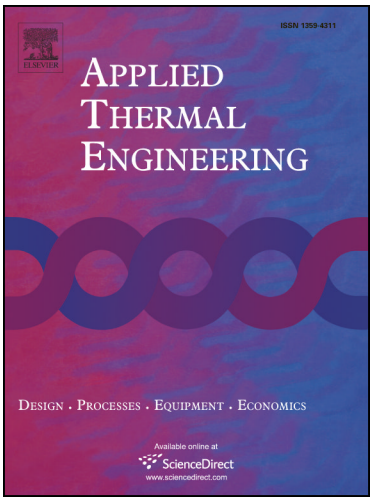

Research Paper

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Numerical investigation on the thermoacoustics characteristics of thermal compressor for the pulse tube cryocooler

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Abstract

Thermal compressor, different from the linear compressor, is one kind of compressor utilizing heat power directly to generate a pressure wave. Combining with the pulse tube cryocooler, it could become a now type high efficiency 4K cryocooler. In present work, a numerical method based on finite volume method was carried out to study the characteristics of thermal compressor. The simulation results were verified by experiments at first. Then the no-load performance of thermal compressor was studied and the results showed that the waves in the thermal compressor no longer obeyed the linear thermoacoustics theory. And then, the RC load method was used to study the output thermoacoustics characteristics of thermal compressor. With a RC load, the wave mode in the thermal compressor would convert into the traveling wave from standing wave. The results showed that thermal compressor was preferable to drive the capacitive load and the best impedance of orifice valve was about 5×10^9 $\mathrm{Pa \cdot s/m^3}$. According to the optimum load impedance optimized above, we can design a suitable PTC for the TCP.

Keywords: Thermal compressor, Numerical simulation, Thermoacoustics, Regenerator

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