

Design Optimization and Thermoacoustic Analysis of Pulse Tube Cryocooler Components

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Abstract : The usage of pulse tube cryocoolers is significantly increased mainly due to the advantage of the absence of moving parts. The underlying idea of this project is to optimize the design of pulse tube, regenerator, a resonator in cryocooler and analyzing the thermo-acoustic oscillations with respect to the design parameters. Computational Fluid Dynamic (CFD) model with time-dependent validation is done to predict its performance. The continuity, momentum, and energy equations are solved for various porous media regions. The effect of changing the geometries and orientation will be validated and investigated in performance. The pressure, temperature and velocity fields in the regenerator and pulse tube are evaluated. This optimized design performance results will be compared with the existing pulse tube cryocooler design. The sinusoidal behavior of cryocooler in acoustic streaming patterns in pulse tube cryocooler will also be evaluated.

Keywords : acoustics, cryogenics, design, optimization

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