
SESSION 13: Cryocooler Analysis & Modeling Techniques

Paper No. 13-3 Thursday Afternoon 2:15 PM

Optimizing Flow Uniformity through Regenerators of Large Cryocoolers Using CFD

A. Ghavami, S.M. Ghiaasiaan, Georgia Tech, Atlanta, GA; C. Kirkconnell, West Coast Solutions, Huntington Beach, CA

Regenerators are a key component of any cryocooler from small to large scale. A desirable regenerator should have low friction factor in the flow direction, high thermal capacity and low conduction from hot to cold end. To achieve these conditions, an advanced regenerator is under development by West Coast Solutions (WCS) and Georgia Tech for a co-axial single stage pulse tube cryocooler with 150W @ 90K cooling power. High flow uniformity through the regenerator at both cold and warm ends is critical for high efficiency performance of the regenerator and reduced flow losses. Any flow non-uniformity deteriorates the regenerator performance in comparison with an ideal one-dimensional operation. This study focuses on optimizing the flow through a large regenerator by designing specific flow distribution components composed of perforated blocks with open and screen mesh-filled plena. All analyses and optimizations are performed using Computational Fluid Dynamics (CFD). The depth of open plenum, mesh screen type, and the number of mesh screens in the mesh screen-filled plenum are among the parameters in the sensitivity and optimization study.