Phase Shifter and Displacer Research, Paper No. 8.6

Development of Stirling Cryocooler Model that Includes a Full Simulation of the Appendix Gap

T. Rawlings, M. Crook, M. Hills, STFC Rutherford Appleton Laboratory, Harwell, Oxford , UK

A new Stirling cryocooler model has been developed at the Rutherford Appleton Laboratory. This one-dimensional finite difference model is able to simulate single and two-stage cryocoolers. The model uses the latest friction factor and heat transfer correlations from the literature and simulates turbulence generation and thermal penetration depths. It runs fast enough to be useful for optimisation, thanks to a robust artificial convergence technique. The model includes a full representation of the cold head, including the displacer motion and flow past the displacer; this enables the optimisation of certain parameters that could not be assessed previously. The model has been used to optimise the geometry of an existing single-stage cryocooler and predicts that significant performance improvements can be made by changing the geometry.