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MODELLING OF OSCILLATORY FLOW THROUGH REGENERATOR OF A STIRLING CRYOCOOLER USING A CORRELATION BASED METHOD

Content :

Stirling cryocooler, Regenerator, Forchheimer's coefficient, Darcy permeability

Summary :

Oscillatory flow through regenerator of a miniature Stirling cryocooler can be modeled using CFD. But the accuracy of the results largely depends on the values of viscous and inertial resistance terms used to model the regenerator as a porous media. This paper presents a friction factor correlation based method for the determination of the directional permeability and Forchheimer's inertial coefficient of the regenerator matrix material. Friction factor for the flow of helium through 325, 400 and 635 mesh SS wire matrices are calculated using standard friction factor correlations and compared with the friction factor correlation given by Clearman et al. in terms of permeability and Forchheimer's inertial coefficient. The friction factor data obtained from Blass and Tong/London correlations were in good agreement with that of Clearman et al. The viscous resistance term D and the inertial resistance term C are calculated from this data and are used to model the oscillatory flow through the regenerator. The predicted pressure amplitude and the phase at the regenerator exit were compared with the reported experimental data. The average deviation of the predicted pressure amplitude from the experimental data was 19.3 %, 15.8 % and 4.7 % for 325, 400 and 635 mesh respectively.

Primary authors : Mr. KISHOR KUMAR, V V (Government College of Engineering Kannur, Kerala-670563)

Co-authors : Dr. BIJU, T Kuzhiveli (Centre for Advanced Studies in Cryogenics (CASC), Department of Mechanical Engineering, National Institute of Technology Calicut, Kerala, India-673601)

Presenter : Mr. KISHOR KUMAR, V V (Government College of Engineering Kannur, Kerala-670563)

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