World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:14, No:05, 2020

Parameter and Lose Effect Analysis of Beta Stirling Cycle Refrigerating Machine

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Abstract : This study is aimed at the numerical analysis of the effects of phase angle and losses (shuttle heat loss and gas leakage to the crankcase) that could have an impact on the pressure and temperature of working fluid for a β-type Stirling cycle refrigerating machine. First, the developed numerical model incorporates into the ideal adiabatic analysis, the shuttle heat transfer (heat loss from compression space to expansion space), and gas leakage from the working space to the buffer space into the crankcase. The other losses that may not have a direct effect on the temperature and pressure of working fluid are simply incorporated in a simple analysis. The model is then validated by reversing the model to the engine model and compared with other literature results using (GPU-3) engine. After validating the model with other engine model and experiment results, analysis of the effect of phase angle, shuttle heat lose and gas leakage on temperature, pressure, and performance (power requirement, cooling capacity and coefficient of performance) of refrigerating machine considering the FEMTO 60 Stirling engine as a case study have been conducted. Shuttle heat loss has a greater effect on the temperature of working gas; gas leakage to the crankcase has more effect on the pressure of working spaces and hence both have a considerable impact on the performance of the Stirling cycle refrigerating machine. The optimum coefficient of performance exists between phase angles of 900-950, and optimum cooling capacity could be found between phase angles of 950-980.

Keywords : beta configuration, engine model, moderate cooling, stirling refrigerator, and validation
Conference Title : ICAE 2020 : International Conference on Applied Energy
Conference Location : Dublin, Ireland
Conference Dates : May 07-08, 2020