Heat transfer enhancement of a Stirling engine by using fins attachment in an energy recovery system

ABSTRACT

Compared to other traditional engines, the Stirling engine is an externally closed heat engine loop with a high theoretical efficiency and low emissions. Due to its multi-fuel capacity, including solar, biogas and geothermal energy, this property is now becoming very advantageous. However, the performance of the Stirling engine is penalized when being integrated with a low heat source. Thus, research on enhancing the engine's performance through heat transfer is highlighted in this paper. A numerical investigation of the effect of circular, pin, and rectangular fins on the efficiency of the Stirling engine is presented in this report. The engine's model was analyzed using computational fluid dynamics (CFD) method and validated with previous study without any additional heat enhancement material. The result recorded an average of difference around 2.15% with other CFD models and 3.13% with experimental results. The engine's model is then added with fins. An increment in the heat transfer rate, efficiency and power output of the engine are obtained and the highest efficiency is achieved by rectangular fins with 19.03%.

Keyword: CFD; Efficiency; Fins; Heat transfer; Stirling engine