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SIMULATION OF A STIRLING ENGINE USED FOR A MICRO SOLAR POWER PLANT: 0-D MODELLING, COMPARISON WITH 1-D MODELLING

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Abstract

The goal of this paper is to determine the characteristics of a Stirling engine able to be used by a micro-solar power plant as energy conversion system. The purpose is to use solar energy as heat source and a Stirling engine because of its numerous advantages, as its high (theoretical) efficiency. This work was made in collaboration with several industrials involved in the project named MiCST, whom objective is to electrify remote villages in Africa. Results of a simple 0-D model built on Matlab®/Simulink® environment to predict engine behavior are compared with those of several 1-D models which take into account several energy losses. It is shown that 0-D model over-estimates the power but keeps its interest because of its simplicity, easy adaptability into a global model of a more complex system and reduced computing time. Empirical correlations whose coefficients are obtained according to experimental results may be used to estimate directly the total power loss.

Key words: energy balance, energy losses, Stirling engine, solar power plant, thermodynamic model

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