EXPERIMENTAL ANALYSIS AND NUMERICAL VALIDATION OF THE SOLAR DISH/STIRLING SYSTEM CONNECTED TO THE ELECTRIC GRID

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Abstract

The use of solar-powered Stirling engines to convert thermal energy into electricity is a promising and renewable technological solution that can contribute to reducing dependence on fossil fuels for electricity generation. Unfortunately, the lack of experimental performance data and operating parameters for this type of technology limits its detailed characterization, difficult its modeling and design and consequently its utilization. This paper aims to validate the mathematical model of the Dish/Stirling system previously published by Mendoza et al. (2017) with the TRINUM system, installed at the Federal University of Itajubá-Brazil. For nominal conditions, the Dish/Stirling system generates an electric power of 1.00 kW at a solar irradiation of 725 W/m² with a system overall efficiency of 17.6%. The results show that for solar irradiance values between 520 and 950 W/m² the experimental tests and the results of the mathematical modeling do not present considerable differences, obtaining an electric power of 1089 W and an efficiency of 17.98%, which represents deviations in the range of 2% to 12%.

Keyword

Solar energy, Solar concentrator, Stirling engine, Numerical validation, Energy conversion, Thermal analysis