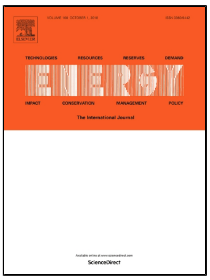
Accepted Manuscript



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PII:	S0360-5442(18)31733-X
DOI:	10.1016/j.energy.2018.08.197
Reference:	EGY 13673
To appear in:	*Energy*
Received Date:	22 January 2018
Accepted Date:	27 August 2018

Please cite this article as: Rouhollah Ahmadi, H. Jokar, Mahmoud Motamedi, A Solar Pressurizable Liquid Piston Stirling Engine: Part 2, Optimization and Development, *Energy* (2018), doi: 10.1016/j.energy.2018.08.197

A Solar Pressurizable Liquid Piston Stirling Engine: Part 2, Optimization and Development

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Abstract

This investigation is devoted to the optimizing a novel pressurizable liquid piston Stirling engine (PLPSE) using particle swarm optimization (PSO) algorithm. The influences of design parameters including pressure intensifier coefficient, pressure intensifier mass, spring stiffness of the intensifier part of the system, the height of the hot and cold liquid columns and the power piston cross-sectional area on the hydraulic output power of the proposed system are studied. Through sensitivity analysis, it is found that some of the parameters have significant effects on the performance of the proposed PLPSE. Based on maximizing the hydraulic output power and stability of the system's steady-state dynamic behavior, some normalized objective functions are defined, and they are converted into a single objective function via weighting summation method. Then, the optimal values of the decision variables are found via an optimization scheme using PSO algorithm with the purpose of minimizing the objective function. Next, the success of the proposed design approach is examined through simulation results. Finally, the designed PFPSE is fabricated and principally tested. It is shown that the mathematical model based results are in a good accordance with the experimental results through which validity and reliability of the presented design method are attained.

Keywords: Stirling pump, Simulation, Solar water pump, Optimization, PSO