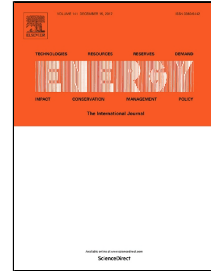


# Accepted Manuscript

Analysis of a displacer-coupled multi-stage thermoacoustic-Stirling engine

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1 **Analysis of a displacer-coupled multi-stage**  
2 **thermoacoustic-Stirling engine**

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6 **Abstract** A new thermoacoustic-Stirling engine is introduced, composed of a compressor,  
7 regenerative assemblies, displacers and an alternator. The regenerative assemblies are coupled  
8 to displacers to successively multiply the acoustic power input by the compressor. The  
9 amplified acoustic power is converted into electric power in the alternator. This new  
10 configuration overcomes the limitations of traditional thermoacoustic or Stirling engines,  
11 including losses in long resonant tubes, response hysteresis and current inversion. The design  
12 method of the displacers and alternators is presented. Numerical simulations are carried out to  
13 investigate the characteristics of this system. Results show that the overall efficiency of this  
14 system could reach 47% with heating temperature of 900 K. Changing alternator load is the  
15 most plausible factor in piston or displacer exceeding the displacement limit. These parts can  
16 be effectively protected as long as the voltage of the compressor can be instantaneously adjusted.  
17 The working frequency, charging pressure and mechanical resistance do not substantially  
18 influence the efficiency and power capacity, when varied within a limited range. This allows  
19 the proposed engine to work stably when these parameters deviate from the design.

20 **Keywords:** thermoacoustic; Stirling; engine; displacer

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