# Prediction of output power with artificial neural network using extended datasets for Stirling engines

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**Abstract**

A Stirling engine is inherently complex in structure and manufacturing process, and its operating mechanism involves thermal-mechanic-electronic (electromagnetic) coupling and complicated nonlinear losses. Therefore, it is difficult to accurately predict the performances by theoretical analysis during the design of a Stirling engine. In the present study, the artificial neural network is used to predict the output power of Stirling engines. Using extended datasets including the isothermal analytical data and the experimental data, two accuracy-improved artificial neural network models that are able to predict the output power for two typical Stirling engine prototypes are developed using Matlab to improve the prediction ability of normal artificial neural network models only based on experimental data. Compared to the normal artificial neural network model, the two improved artificial neural network models achieve maximum improvements of over 50% and 20% in average prediction error for Ford 4-215 engine and General Motors 4L23 engine, respectively. The results also demonstrate that the two improved artificial neural network models have better robustness to the quality of experimental data samples. This research provides an effective approach based on the artificial neural network methodology to predict the performances of Stirling engines.

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