SEQUENTIAL OPTIMIZATION OF BIODIESEL-PRODUCER GAS DUAL FUEL ENGINE OUTPUT PARAMETERS USING ARTIFICIAL NEURAL NETWORK

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Keywords:

Diesel engine, bio-diesel, artificial neural network (ANN), Engine performance.

Introduction:

An Artificial Neural Network in the field of Artificial intelligence where it attempts to mimic the network of neurons makes up a human brain so that computers will have an option to understand things and make decisions in a human-like manner. The artificial neural network is designed by programming computers to behave simply likeinterconnected brain cells.

A neural network is made of artificial neurons that receive and process input data. Data is passed through the input layer, the hidden layer, and the output layer. A neural network process starts when input data is fed to it. Data is then processed via its layers to provide the desired output. Dual fuel operation with biodiesel producer gas and Hydrogen combination resulted in lower thermal efficiency with acceptable emission levels. Hydrogen addition to HsOME -producer gas combination decreases the power derating. Smoke was considerably decreased, but marginal increase in nitric oxide emission with hydrogen addition is noticed.

Objectives:

Neural networks are feasibly handling almost any computational or contemplative task automatically, with greater processing power than the human brain. Neural networks reflect the behavior of the system; allowing computer programs to recognize accurately optimized parameters and solves complex problems. In addition, it lowers the time of experimentation. Therefore this technology is planned to employ for engine applications. In the present study, the performance and exhaust emissions of a diesel engine using biodiesel and producer gas combination were investigated using artificial neural networks (ANN). The engine was run with biodiesel and producer gas combination at various engine operating variables to obtain the test and training data required to build the ANN model. In the designed ANN model, thermal efficiency, exhaust gas temperature and different emission

levels were selected as the output layer while injection timing, injection pressure and compression ratio were selected as input layer. An ANN model was developed using some of the experimental results for training. The performance of the ANN model was measured by comparing the test data generated from the unused part of the training.

Engine specifications

Engine	Single cylinder, four stroke water cooled diesel engine
Fuel	H. S. diesel
Rated Power	3.5 kW @ 1500 RPM
Cylinder diameter	87.5 mm
Stroke length	110 mm
Connecting rod length	234 mm
Compression ratio very	12 to 18:1
Orifice diameter	20 mm
Dynamometer arm length	185 mm

Methodology:

1. Experimental data collection
2. Data pre-processing- In data pre-processing, the appropriate predictors are selected as inputs before processingto a network for mapping. It is a technique that is used to convert the raw data into a clean data set. In other words, whenever the data is gathered from different sources it is collected in raw format which is not feasible for the analysis.
3. Importing the dataset- Uploading data's to google collab software
4. Building ANN model
5. Training ANN model
6. Making prediction and evaluation of ANN model
7. Comparing the experimental data with predicted results

Conclusion:

ANN was proved to be an effective predicting tool that could be used to predict the engine performance regardless of engine types when provided with input parameters and desired output parameters. ANN was able to performance prediction well with sufficient information that was provided for Ann to learn the relationship between given information. However the chosen training algorithm and training function for the prediction will affect the correlation coefficient and mean squared error of the predicted results and experimental results. Thus ANN is able to generate predicted results with close proximity to the experimental results.

This study showed that ANN could be used as an alternative to classical modelling techniques as ANN was able to predict the performance and emissions of engines accurately.

Loss of predicted value Vs test value for output parameters, brake thermal efficiency for a designed ANN model came out to be 1.1015. Similarly the losses of other parameters have been tabulated below

Scope for future work:

Neural networks are arguably the technological development with the most potential currently on the horizon. Through neural networks, we could feasibly handle almost any computational or contemplative task automatically, and someday, with greater processing power than the human brain. For now, neural networks are still in their infancy, but already, they're an impressive technology responsible for tremendous breakthroughs in everything from speech recognition to medical diagnoses.