The Prediction of Diesel Engine NO_x Emissions using Artificial Neural Network

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Abstract

This paper describes an experimental and computer simulation studies used to develop a suitable algorithm to predict and control the oxides of nitrogen (NO_x) emitted from the Yanmar L60AE-D single cylinder direct injection diesel engine, fitted in a Cusson's Engine Test Bed Model P8160. NO_x contained in the exhaust gases of diesel engines have been identified as elements responsible for polluting our atmosphere. In order to reduce or to control diesel engine polluting emissions, the formation mechanism of NO_x can be predicted. A neural network model is developed to obtain the NO_x emission concentration under various operating condition. The neural network, well suited for non-linear phenomena modelization, is able to deal with high uncertainly input level and able to operate outside of their range of training experience. A feedforward neural network structure has been selected with a backpropagation training procedure. Four operating parameters (engine speed, engine load, exhaust temperature and air fuel ratio) have been used as an input data in the modelling process. The modelling algorithm implemented, takes a large set of measurements to learn how to predict the NO_x emission from four operating parameters. The predicted values obtained using neural network model are compared with the experimental values. The studies show that the predicted results are in good agreement with experimental values, within less 9 % relative error.

Keywords: NO_x prediction, NO_x emission simulation, NOx data collection and modelling, Diesel engine modelling, Neural networks