user story

Applying Neural Networks to advanced engineering

Turbocharger compressor map example

SUMMARY

• Neural Networks were applied as surrogates of the two turbo-compressor maps.

• The network was constructed using 5 layers and two neurons for the input layer.

•20 datapoints were used to train the network

It is common for large amounts of data to be gathered either experimentally or obtained from high fidelity computationally expensive numerical models.

Using this data effectively or to build sub-component models is carried out by building model surrogates such as Neural Networks. Furthermore, surrogates offer rapid/computationally cheap evaluation.

THE CHALLENGE

To train a Neural Network to reproduce the raw turbo compressor maps of mass flow rate and thermal efficiency presented in Figure 1.

SOLUTION

A 5 layer network with three hidden layers was used for this analysis. Two neurons were used in the input layer as these data points are a function of both compressor speed and the pressure ratio. A total of 20 data points per map were used as the initial training dataset.

RESULT

The results are presented in Figure 2, showing the output values generated by Neural Network simulation. Both maps are reproduced by the Neural Network with a high degree of accuracy.

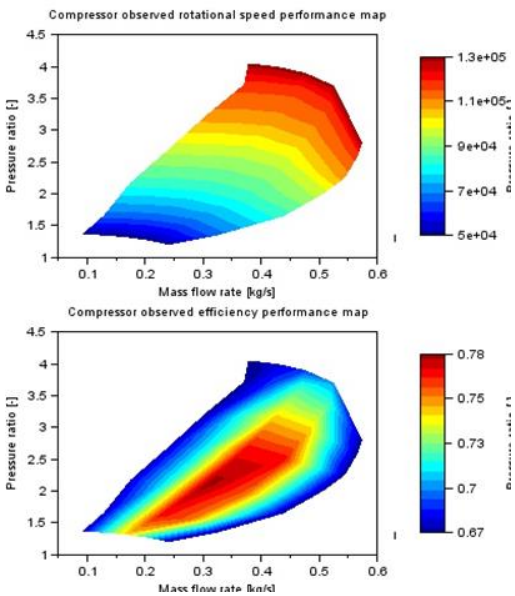
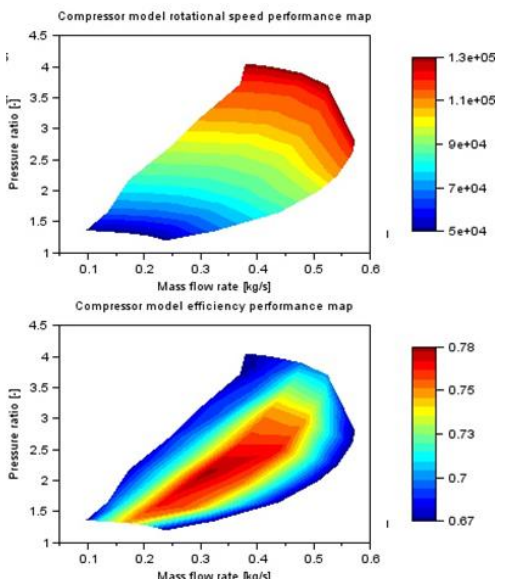


Figure 1 (Left): Observed compressor map in terms of engine speed (above) and thermal efficiency (below).

Figure 2 (Right): Network representation of engine speed (above) and thermal efficiency (below).



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