Model Based Thermotronic Systems

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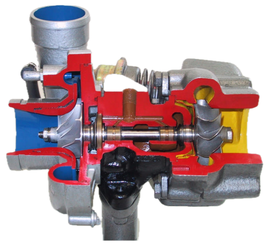
Scope

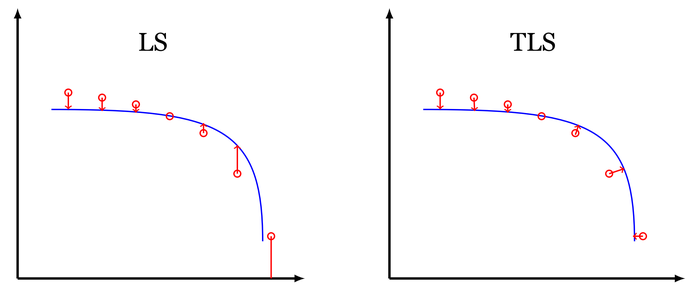


- Internal combustion engines (ICEs) remain essential in heavy duty transportation due to their durability and efficiency.
- Accurate modeling of turbocharger performance is critical for engine research, control, and diagnostics.

Current Activities

Two methods for fitting compressor models to data have been evaluated using different compressor models.

- Total Least Squares (TLS)
- Least Squares (LS)



Total Least Squares

The *TLS* assumes there to be errors in all dimensions as shown in the figure below, where *LS* and *TLS* is illustrated.

$$TLS = \min \left(\sum_{i=1}^{N} \left(\left(\frac{y_i - \hat{y}_i}{\max(y)} \right)^2 + \left(\frac{x_i - \hat{x}_i}{\max(x)} \right)^2 \right) \right)$$

- Assumes errors in all dimensions
- Calculates the orthogonal distance between estimation and data

Method

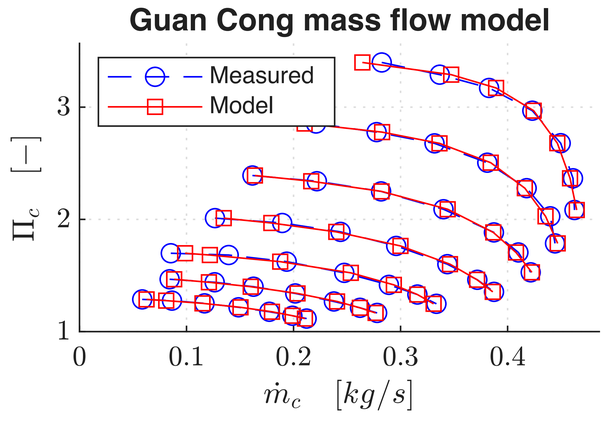
Six models where fitted to three different compressors of varying sizes, one car, one truck and one marine compressor, and the data was picked out in different configurations.

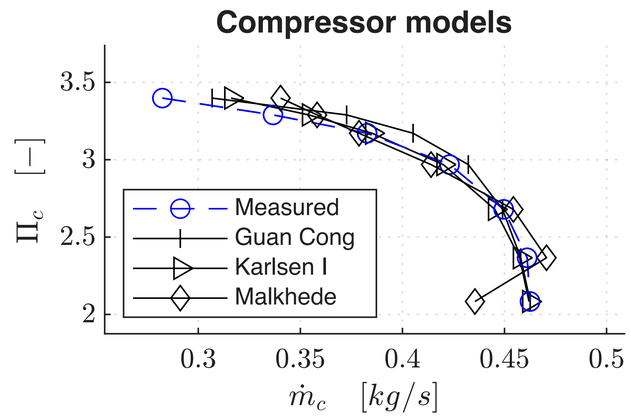
- The whole data set.
- Reserving the fastest and slowest speed line for validation, one at the time, and training on the remaining data.

Results

The results show that

- The *TLS* method outperforms the traditional *LS* approach
- The *TLS* method considers errors in both input and output variables, giving a better visual fit.





Acknowledgements

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Contributions to SEDDIT Goals

- Further developing digital twins for internal combustion engines to reduce the carbon footprint

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