Model based thermotronic systems

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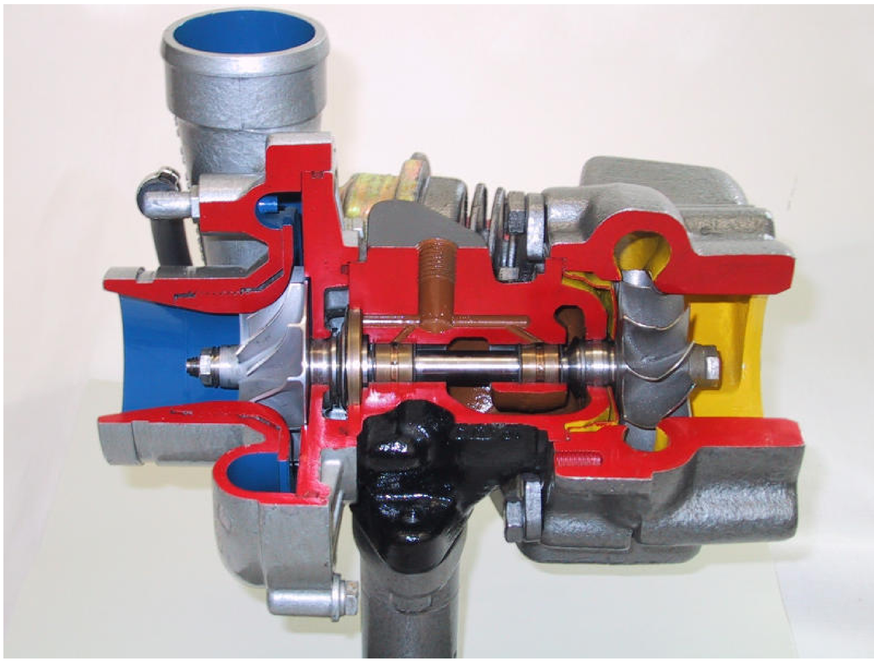
Introduction

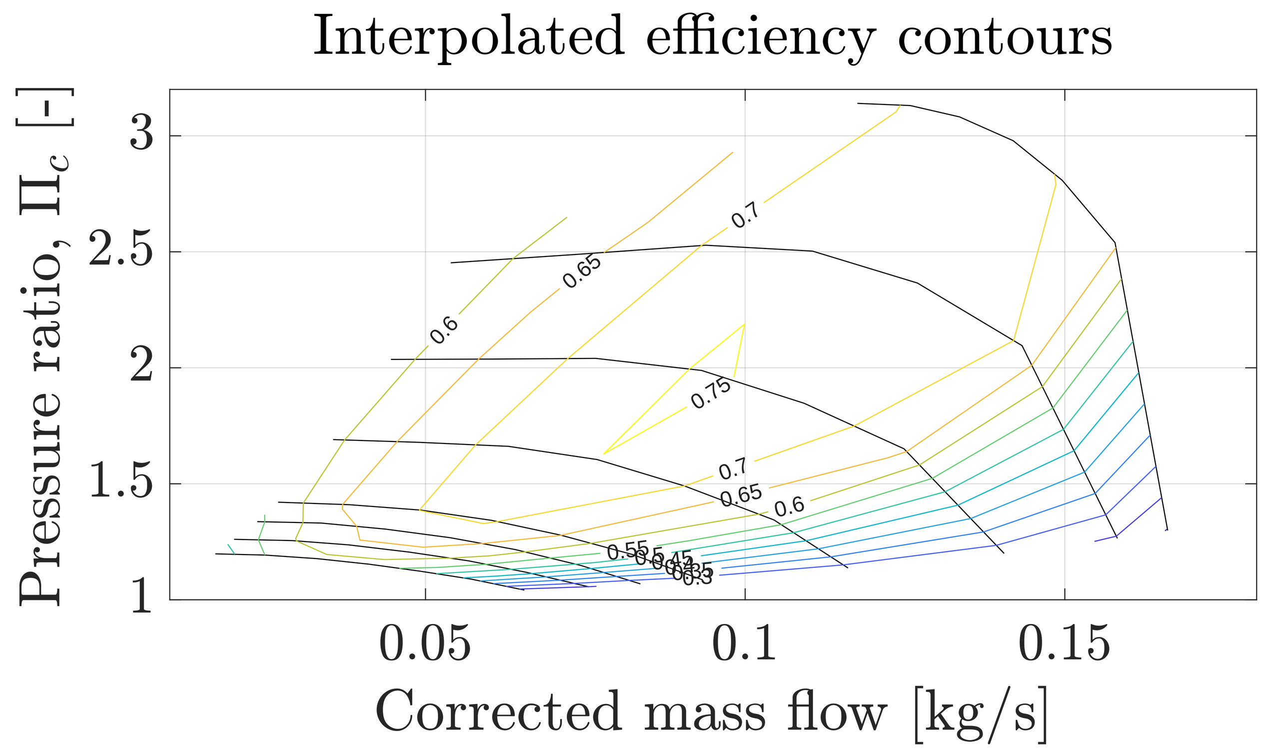


The project will begin with a comprehensive exploration of turbocharger performance, focusing on both the compressor and turbine sides. The initial phase aims to develop a solid understanding of how these components function individually and in unison, providing insights into the critical role they play in engine performance. Following this, the project will delve into the modeling of internal combustion engines (ICEs), which requires a thorough understanding of thermodynamics and its control, i.e. thermotronic systems. This aspect of the study will cover the fundamentals of energy transfer, combustion, and efficiency within ICEs, which is essential for accurate modeling.

The initial task

The exploration will start with an investigating, comparing and evaluating different compressor modeling methods. Total least squares will be the evaluation method since it assumes that there is measurement errors in both predictor and response variables and thus takes the euclidean norm of the error rather than in just one dimension. The error in this situation is the distance between the true and modeled speed line. The models will not only be evaluated on the their ability to adapt to the speed lines other criteria can be found below:

- The number of parameters required to be adapted.
- Its ability to adapt to different circumstances, if there is a situation where the number of measurement points are limited, how will the model cope?
- Is it possible to go back and forth between the mass flow vs pressure graph and the mass flow vs efficiency graph?
- The ease of use, how difficult is it to approximated each parameter?



Possible outlooks

The knowledge gained from these investigations are applicable to a wide range of research areas. For instance, it can be drive further development of ICEs using bio-fuels, pushing the boundaries of efficiency and emissions control.

One of the researchers questions are if it is possible to see a difference in performance and/or behavior between a ICE running on bio fuels and one running on fossil fuels. If it is possible, how can that information be used in the transition towards more sustainable transportation?

Another potential research area is hydrogen driven vehicles, an area where knowledge for the ICE modeling is directly applicable. It can be described with the same thermodynamic theory as an ICE.

Another interesting area is the potential for using ammonia as fuel instead of diesel in large marine diesels. It has similar behavior as diesel, it has to be heated before combusting. Ammonia would not harm the environment if spilled since it is part of the nitrogen cycle and is one of the most transported goods globally.

Summary

This project has a main driver sustainable transport and could develop and expand into:

- Compressor modeling
- Internal combustion engines running on bio-fuels
- Hydrogen powered vehicles
- Ammonia powered commercial vehicles

Acknowledgements

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