LiU Diesel 2

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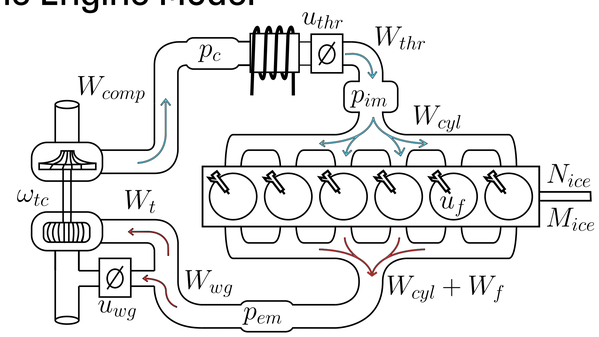
Abstract

The pursuit for lower fuel consumption and stricter emission legislation has made a simulation- and optimization-based development methodology important to the automotive industry. The keystone in the methodology, is the system model. But for the results obtained using a model to be credible, the model has to be validated. A mean value engine model of a 12.7 liters CI inline 6 cylinder heavy-duty engine is validated and released as open-source.

The Engine Model



Ekberg, K., Leek, V., and Eriksson, L. (2018). Validation of an open-source mean-value heavy-duty diesel engine model. In *59th Conference on Simulation and Modelling (SIMS 59)*. Oslo, Norway.

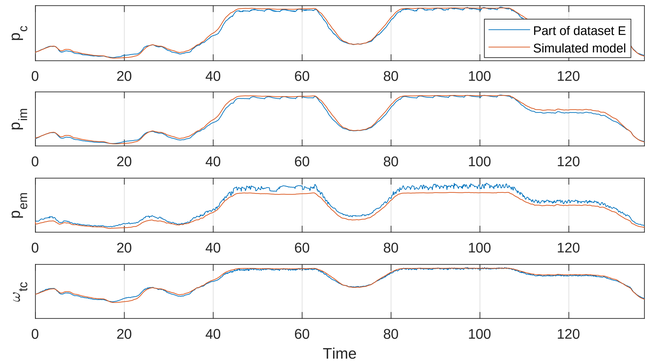
Contribution

The main contribution of this project a validated open-source MVEM of a Scania 12.7 liters engine, downloadable from `www.fs.isy.liu.se/Software/`. Also, new component models for the engine torque are introduced, and an adaptation of an existing turbine model is introduced.

Results

- ✘ 4 states:
  pressure after compressor p_{c}, intake manifold pressure p_{im}, exhaust manifold pressure p_{em} and turbocharger rotational speed ω_{tc}
- ✘ 3 controls:
  injected fuel u_{f}, wastegate position u_{wg} and throttle position u_{thr}
- ✘ 1 independent input:
  engine rotational speed N_{ice}

Model Performance

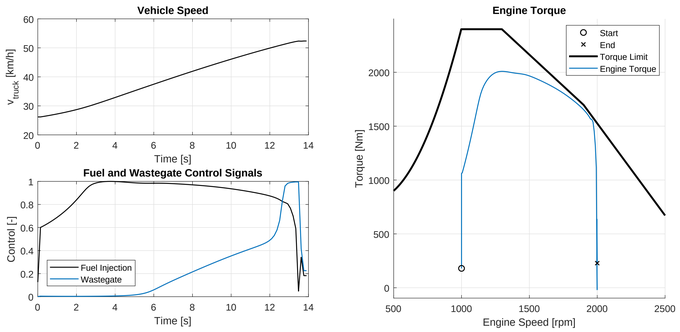


Conclusions

A mean value engine model of a Scania 12.7 liters heavy-duty diesel engine has been developed and validated using both stationary and dynamic measurements. The results show good agreement with measurements, showing that both dynamics and steady-state levels are well represented indicating that the model is well suited for studying the engine dynamics and fuel optimal control. The model is open-source and downloadable from `www.fs.isy.liu.se/Software/`.

Example usage

One usage example is to connect the engine model to a vehicle model, to investigate fuel optimal acceleration of a vehicle. The acceleration is performed from a pre-defined initial speed to a set final speed. First, the stationary fuel optimal start and end points of the acceleration are found with optimal control. Another problem is then stated to accelerate the vehicle from the first fuel optimal point to the next. The results are displayed in the following figure:



Acknowledgements

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