Objectives / Expected Results

WP Leader: Dr. M. Moser, T. Moeller

Cut operating, maintenance and deployment costs

- Develop systems, methods an processes for improved engine lifetime performance

Reduction of emission & increased efficiency at part load

- Cylinder cut-out
- NOx: expanding operation range emission reduction technologies
- Particle: novel lubrication injection system

Enhance dynamic performance

- Model-based control

Partners:

University of Bremen

Vienna University of Technology

Karlsruher Institute of Technology

Linköping University

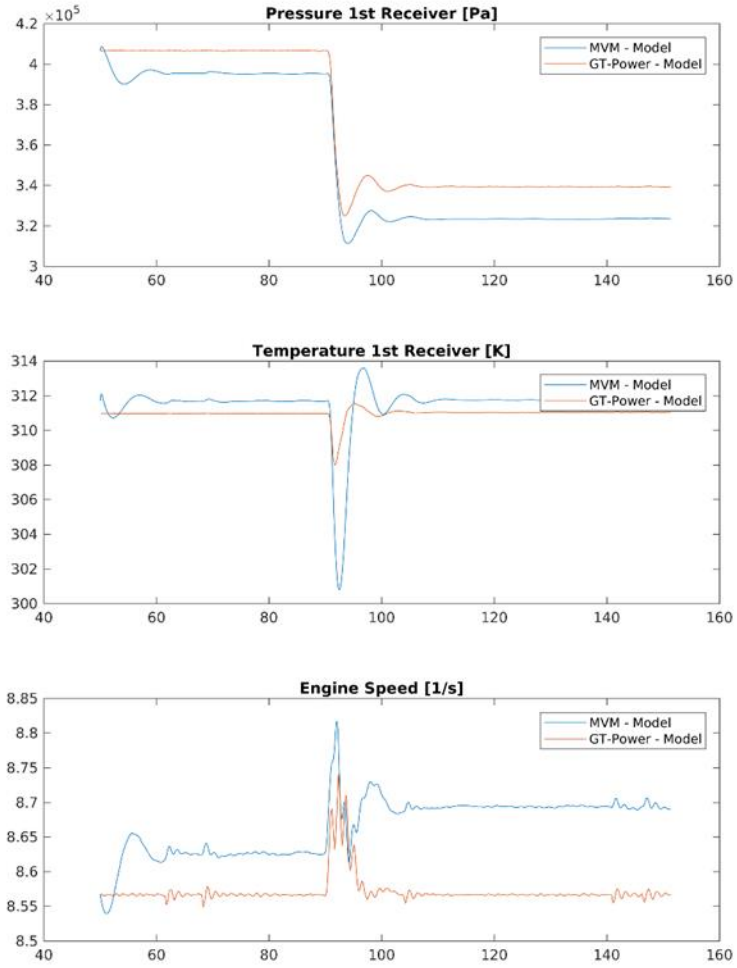
Aventics GmbH

Technical University of Denmark

National Technical University of Athens

Engine control and optimization

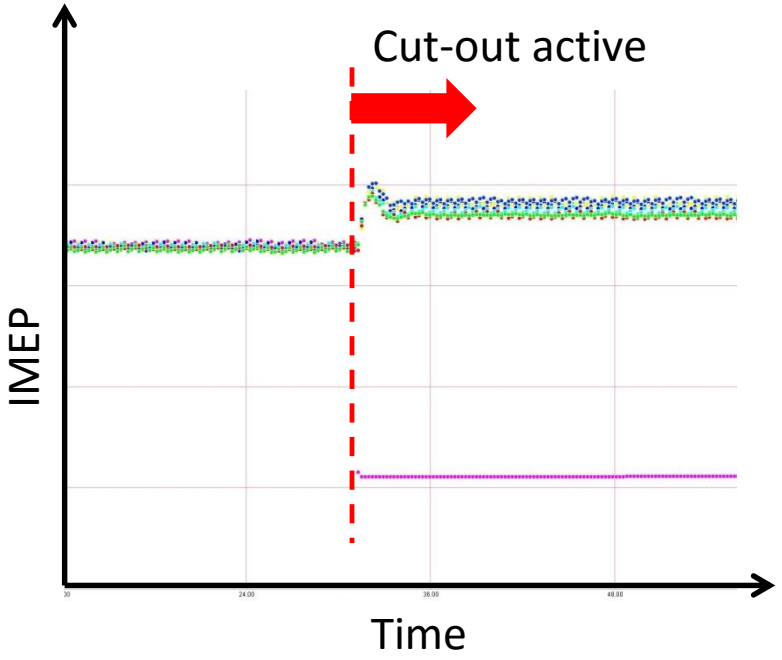
- Development of physical-based models for Model-based engine control
- Combustion model developed and implemented
- Feasibility study concerning optimal control done
- Volumetric efficiency of the engine (volumetric pump) modeled
- Comparison of the developed model with the GT-Suite results
- Model build up in Matlab/Simulink and C++
- Example for optimal control proposed
- Next steps are tuning MPC and LQR controller

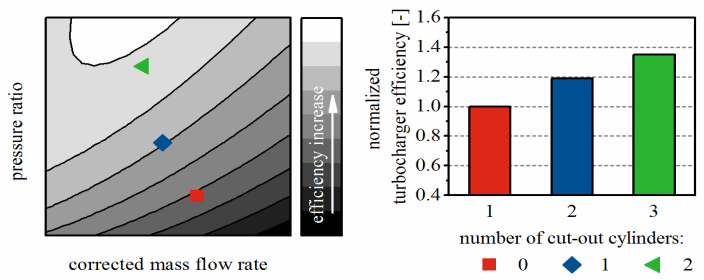


Engine control and optimization

- SW-function for low load operation with cylinder cut out (static, dynamic, different amount of cylinders) was developed
- First SW validation with the help of MiL-simulations done
- SW validation on the HiL test bench have been done
- Test on the engine will be performed on November / December

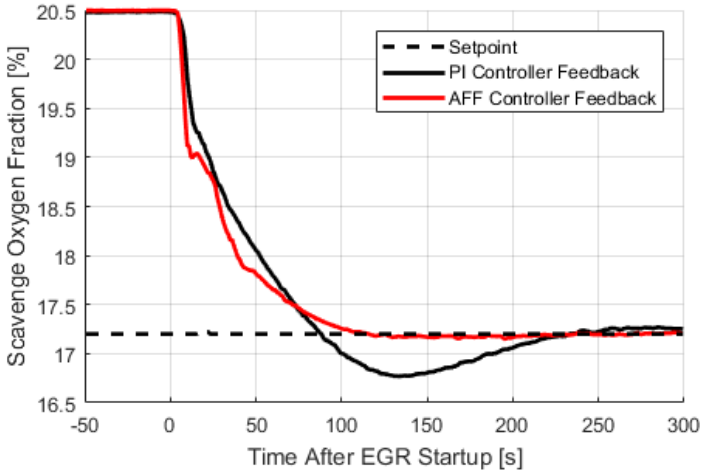
- Publication of paper “Investigation of the Cylinder Cut-Out for Medium Speed Dual Fuel Engines” on the Heavy-Duty-, On- und Off-Highway-Motoren congress



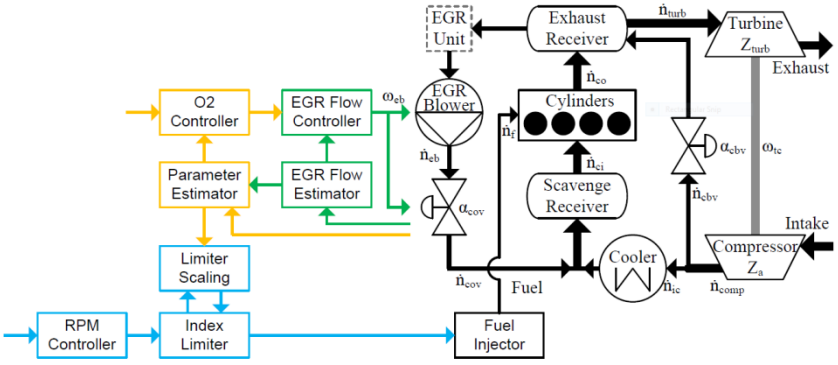


Engine control and optimization

- A new EGR controller has been implemented as part of MDT's Emission Reduction Control System software package
- The new EGR controller was tested as part of an engine shop test
- The shop test showed improved transient performance, when compared to the previous controller
- Vessel maneuvering patterns analyzed (ongoing).
- New EGR controller implemented
- New EGR controller tested in shop test
- Next steps will be finish analysis of vessel maneuvering patterns
- Test new EGR controller on vessel during maneuvering

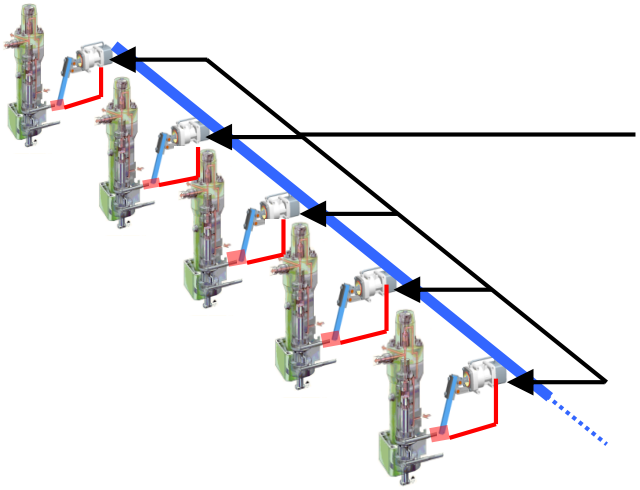


Comparison of old (PI) and new (AFF) EGR controller performance.



New EGR control design.

Engine control and optimization



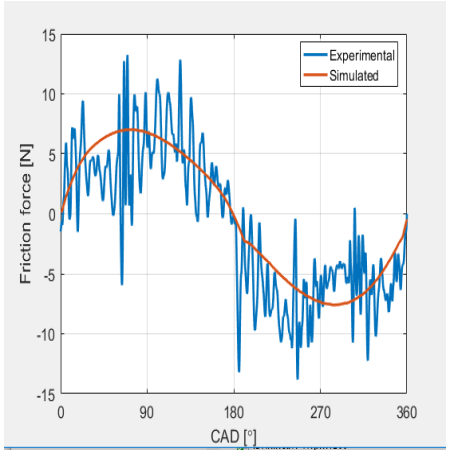
- Development of a retrofit solution for continuous engine performance optimization for mechanical controlled engines
- Electronically controlled actuator for fuel injection
- Prototype sample designed, produced and available
- Prototype sample tested on the test bed

- ➢ Due to drop in fuel oil price no field test carrier could be found
- ➢ No further prototype samples will be produced

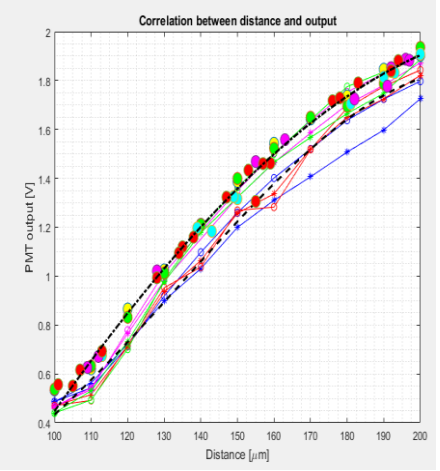
WP 6.5 further development stopped

Engine control and optimization

- New numerical techniques have been developed for keeping track of accumulated lubricant in front of the piston ring. The method has been accepted and published in a high ranking journal
- Experiments made for measuring and computing the friction force and lubricant transport across the piston ring
- Validation of previous work with creating numerical models to simulate the lubricant behavior
- Correlations between distances/lubricant film thicknesses and outputs are made for calibration the system in order to convert a given output to a real distance for later experiments



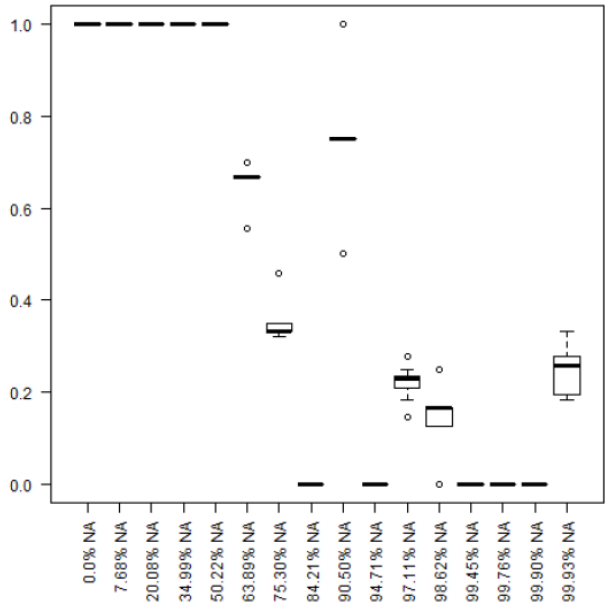
Friction force as a function of the crankshaft position for an engine velocity of 900 RPM.

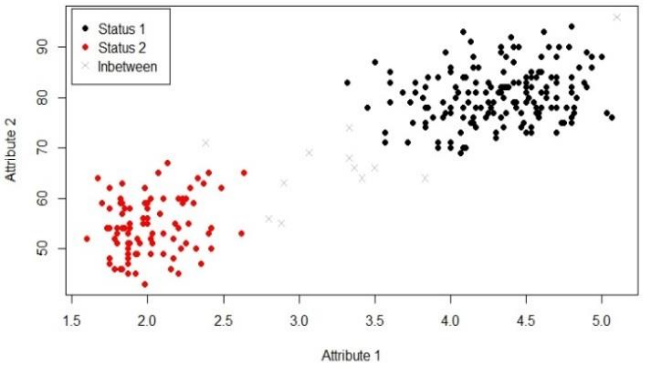


Correlations between distances/lubricant film thicknesses

Remote monitoring & software distribution

- Development of a stream based sub space search method witch allows to analyze data streams
- Data clustering based on DBSCAN algorithm into well defined states (Mahalnanobis - distance)
- Investigation of “Concept Drifts” and compression quality
- Investigation of new compression algorithm which takes dependencies of different data values into account will be performed
- Further improvement of subspace-search method will be done





Methode\NA's	7.68%	20.08%	34.99%	50.22%	63.89%	75.30%	84.21%	90.50%
Interpolation	2.97	4.11	4.65	3.52	36.24	41.25	41.25	40.80
LBw	3.48	3.08	4.30	10.20	40.48	40.30	40.89	40.89
kNN	4.95	6.94	14.79	12.73	30.19	39.71	41.13	39.90
Random Forest	4.24	8.21	12.61	21.61	31.95	40.41	40.41	39.45