

WP6 Model-based Control and Operation Optimization



WP OBJECTIVES

- Reducing operating, maintenance and deployment costs
- Enhance dynamic performance
- Reduction of emission in low load operation
- Increased part load efficiency

WG calculation

$$\begin{aligned}\dot{m}_w(t) &= c_d \cdot A_{geo}(t) \cdot \rho_2(t) \cdot v_2(t) \\ &= c_d \cdot A_{geo}(t) \cdot \frac{p_2(t)}{\sqrt{R \cdot \vartheta_2(t)}} \cdot \psi(\Pi_2(t))\end{aligned}$$

Parameter identification

$$\begin{aligned}\dot{m}_c(t) &= g_1(n_{TC}(t), \Pi_1(t), \vartheta_1(t)) \\ \eta_c(t) &= g_2(n_{TC}(t), \Pi_1(t), \vartheta_1(t)) \\ \dot{m}_T(t) &= g_3(n_{TC}(t), \Pi_2(t), \vartheta_2(t)) \\ \eta_T(t) &= g_4(n_{TC}(t), \Pi_2(t), \vartheta_2(t))\end{aligned}$$

EXPECTED OUTCOME

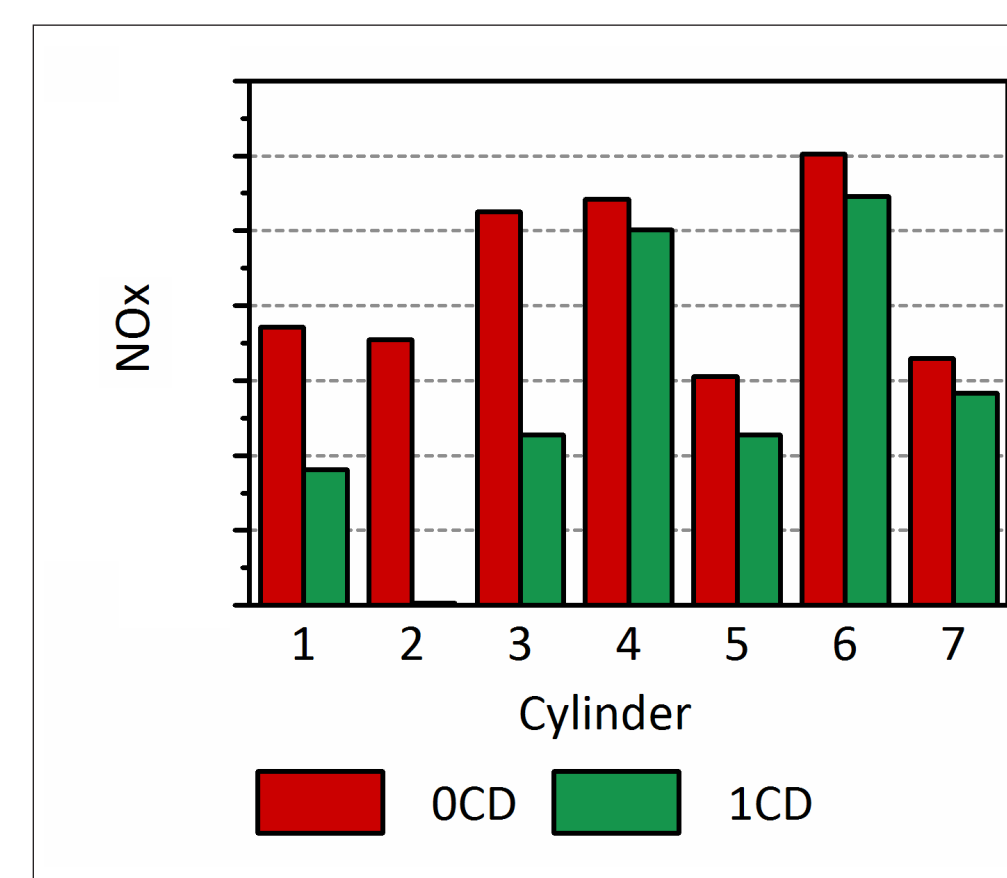
Engine control and optimization

- Model-based engine control
- Part load optimization due Cylinder cut out and expanding the operating range of EGR and SCR systems
- Continuous combustion control of mechanically controlled engines
- Novel lubrication injection system

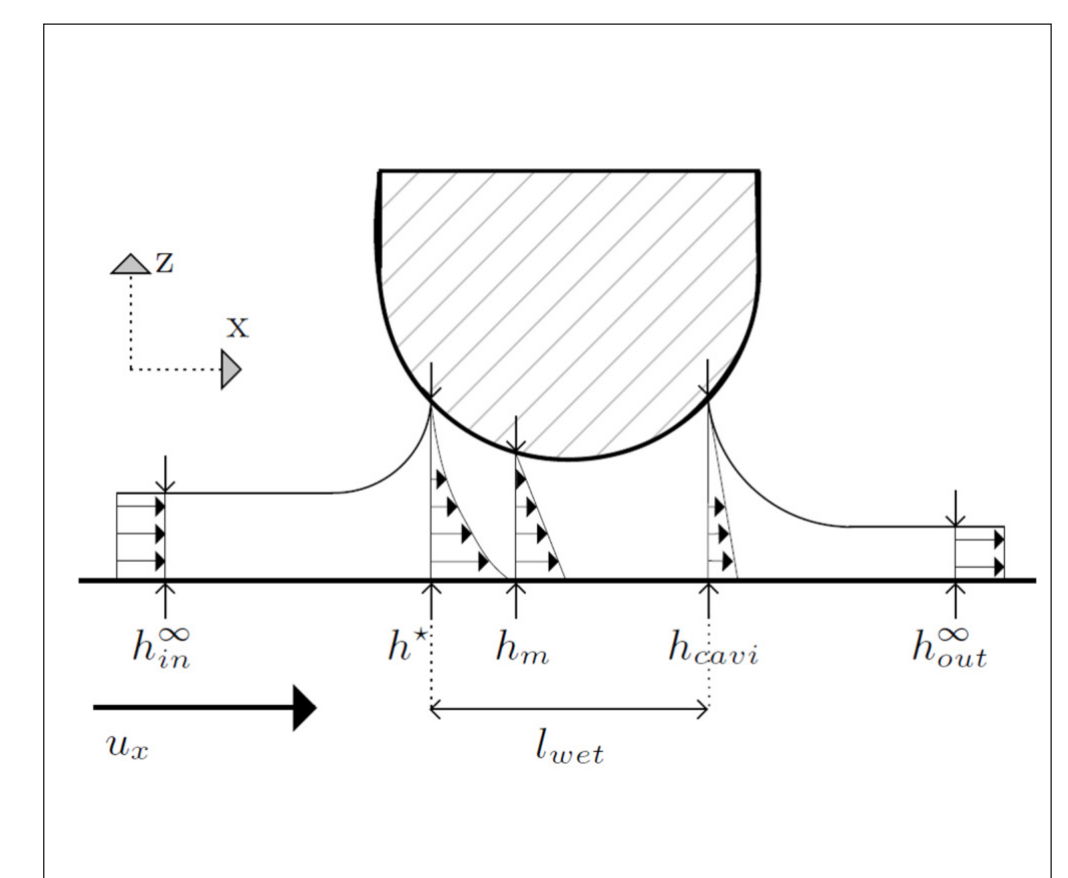
Remote monitoring & software distribution

- Algorithms for failure detection and plant analysis
- Lifetime managed engine software deployment

NO_x reduction

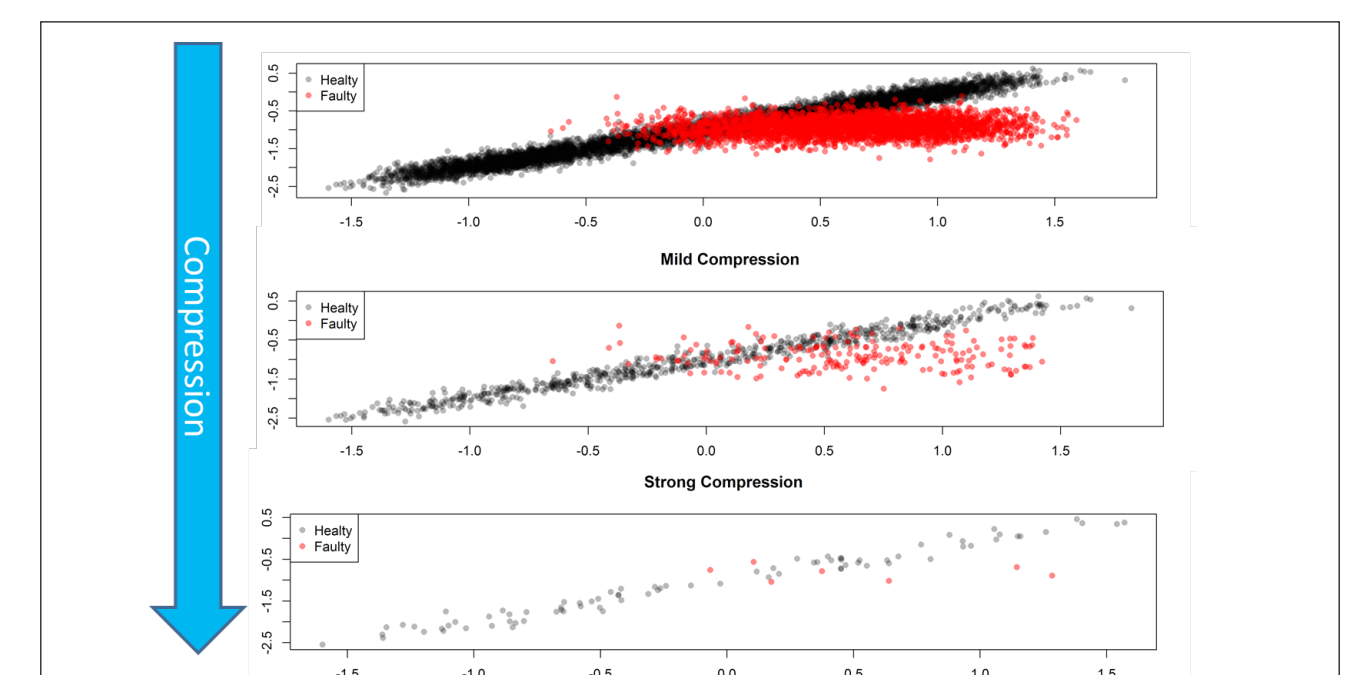


Hydrodynamic lubrication

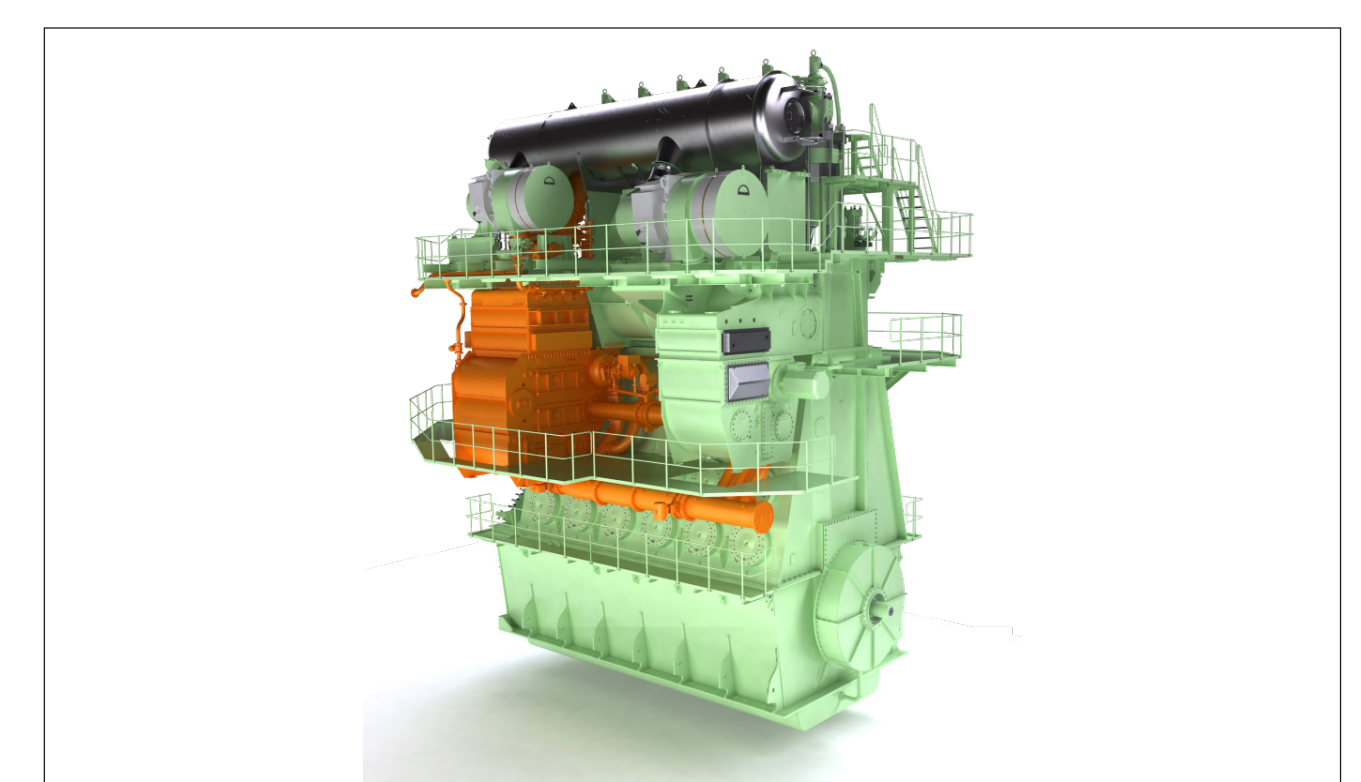


PROGRESS AND PLANS

- Numerical problems with the engine models could be solved by implementing a new solver for the differential equations. Next step will be the validation of the models and the development of first MB-controllers
- Combustion model for cylinder cut out was optimized and promising simulation results could be achieved in terms of emission reduction at part load. Implementation of EGR and SCR models are on track. After finishing the integration the models will be fitted with the help of measurement data
- Prototype part by Aventics available. Concept evaluation in progress
- A proposal for a theoretical model to investigate the hydrodynamic lubrication of the top compression piston ring has been made. Further investigations concerning the squeeze term and the effect on the model ongoing
- Investigation of detection quality depending on compression ratio was done
- Model for secure remote connectivity including management of access authentication between multiple partners ready to be validated



Data compression vs. accuracy



Emission reduction system

WP PARTICIPANTS

MAN Diesel & Turbo SE • University of Bremen: Prof. Büskens • Vienna University of Technology: Prof. Lauer • Karlsruher Institute of Technology: Prof. Böhm • Linköping University: Prof. Eriksson • Aventics GmbH: A. Rüther • Technical University of Denmark: Prof. Glarborg • National Technical University of Athens: Prof. Kyratos

