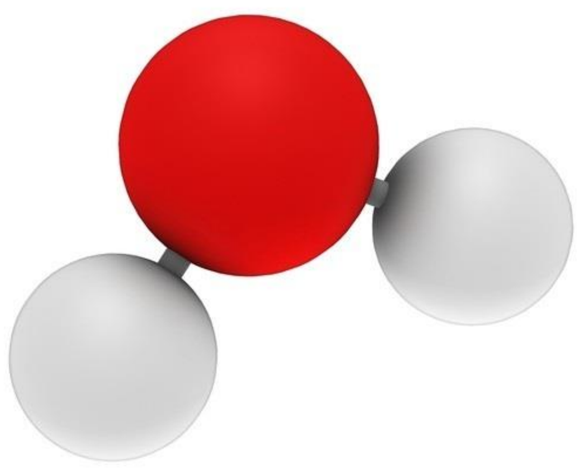


WP 6 Model-based Control and Operation Optimization

WP OBJECTIVES

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

WG calculation

$$\dot{m}_W(t) = c_d \cdot A_{geo}(t) \cdot \rho_2(t) \cdot v_2(t)$$
$$= c_d \cdot A_{geo}(t) \cdot \frac{p_2(t)}{\sqrt{R \cdot \vartheta_2(t)}} \cdot \psi(\Pi_2(t))$$

Parameter identification

$$\dot{m}_C(t) = g_1(n_{TC}(t), \Pi_1(t), \vartheta_1(t))$$
$$\eta_C(t) = g_2(n_{TC}(t), \Pi_1(t), \vartheta_1(t))$$
$$\dot{m}_T(t) = g_3(n_{TC}(t), \Pi_2(t), \vartheta_2(t))$$
$$\eta_T(t) = g_4(n_{TC}(t), \Pi_2(t), \vartheta_2(t))$$

ACHIEVEMENTS & FINAL RESULTS

Reduction of emission, increased efficiency at part load and enhanced dynamic performance

Part load emission reduktion and efficiency increase

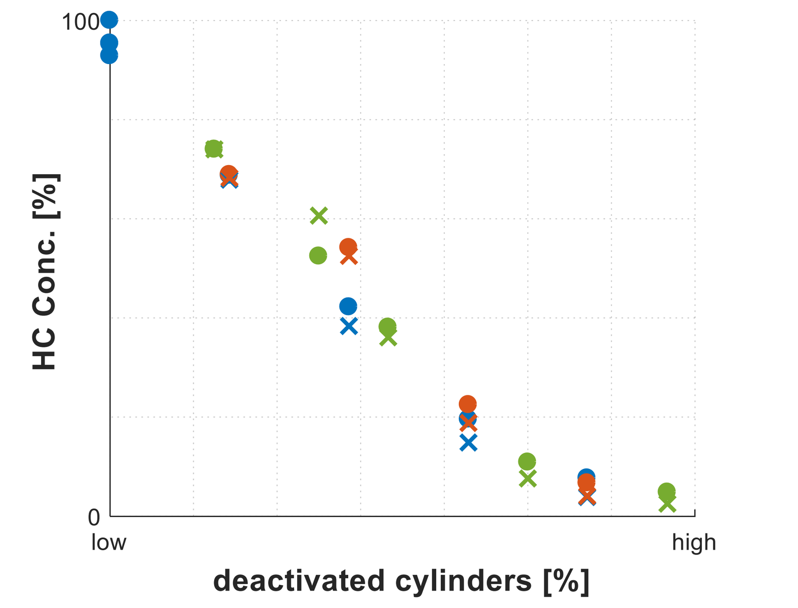
- Up to 50% reduction of NOx emission
- Up to 97 % reduction of HC emission
- Up to 38% efficiency increase
- Increased combustion stability
- Strong reduction of smoke emissions and very good O_2 control performance
- Prediction of lube oil consumption possible
- An optimum between lubricant consumption and asperity contact friction was found

Dynamic performance

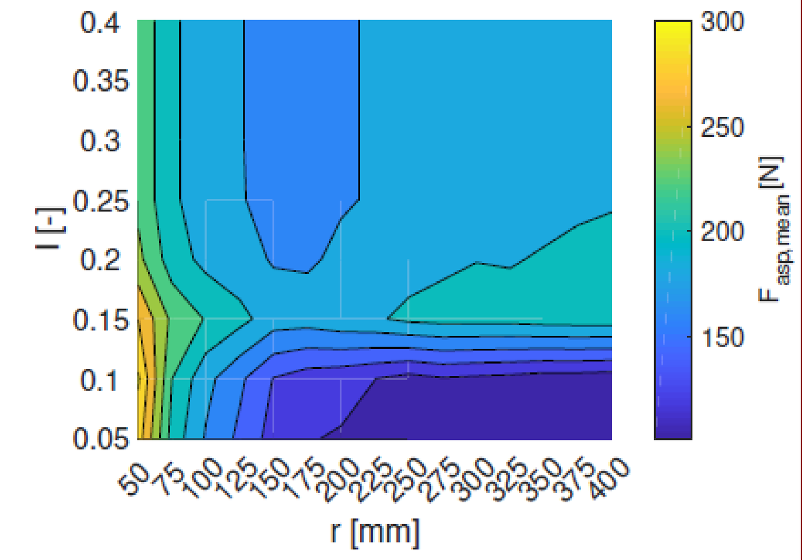
- LQR control performs better then PID, less speed undershot and more precise actuation of devices
- Huge effort to build up the model for the LQR control

Cut operating and maintenance costs

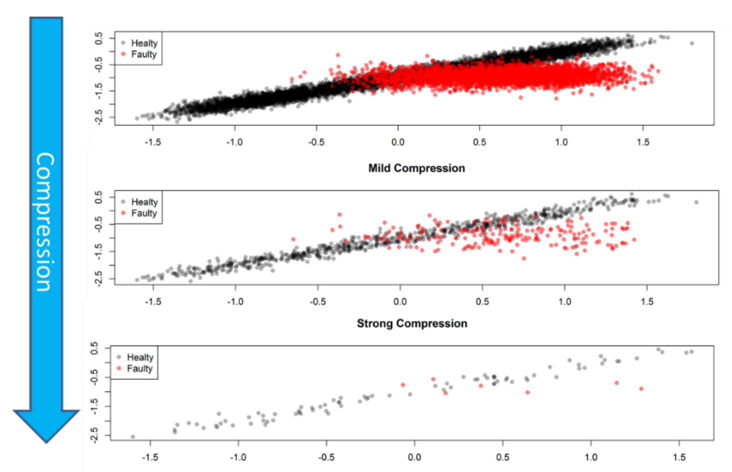
- Electronically controlled actuator for fuel injection tested on Jeppesen Maersk
- Tailored sub space search algorithms investigated
- Influence of data compression on space search investigated (above 60% compression the data quality gets to worse for sub space search)



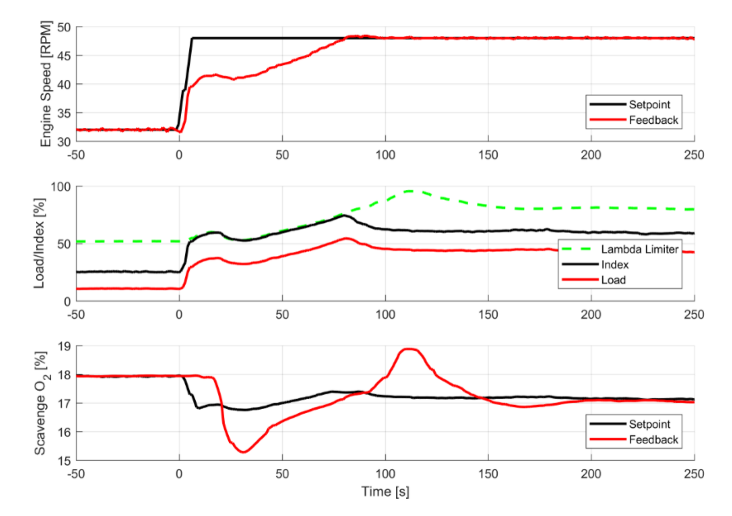
Cylinder cut out emission reduction



Correlation friction, ring curvature lubricant injection position



Data compression vs. accuracy


EGR control behavior

WP PARTICIPANTS

University of Bremen: Prof. Büskens

Vienna University of Technology: Prof. Lauer

Karlsruher Institute of Technology: Prof. Böhm

Linköping University: Prof. Eriksson

Aventics GmbH: Mr. Suedekum

Technical University of Denmark: Prof. Glarborg

National Technical University of Athens: Prof. Kyrtatos

WP Leader: Dr. Mathias Moser (mathias.moser@man-es.com), Torbjoern Moeller (Torbjoern.Moeller@man-es.com)