Investigating the Effect of Octane number and EGR on HCCI Operation with a Stochastic Reactor Model based Engine Cycle Simulator

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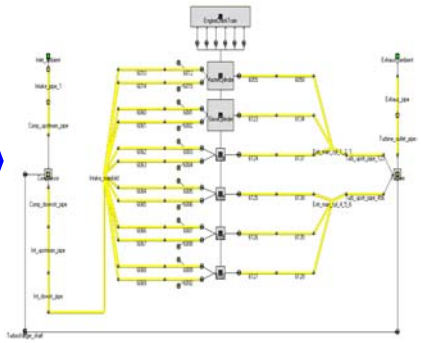
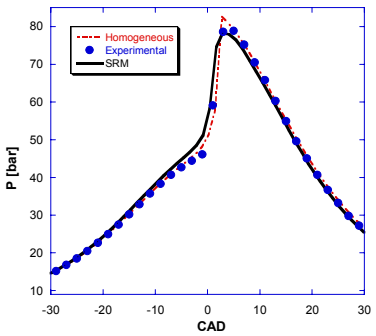
Summary: We present a design tool based on stochastic reactor model (SRM) integrated with a 1-D fluid dynamics engine cycle code to simulate a turbocharged SCANIA truck engine and a RICARDO E-6 engine, running in HCCI mode. In particular the effect of octane number variation and external EGR on combustion and emissions is investigated.

SCANIA 6 cylinder turbocharged HCCI engine

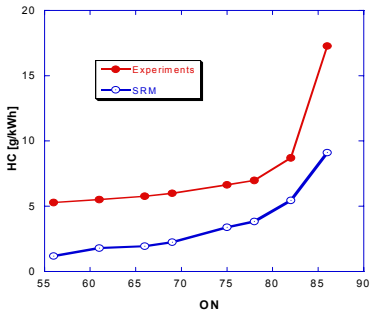


In-cylinder pressure profile

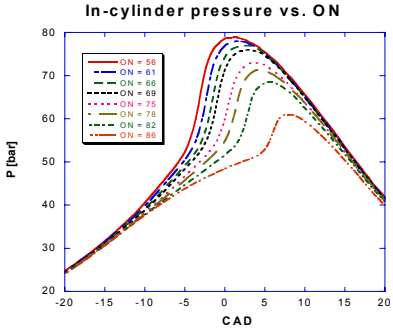


- **Full-cycle simulation:** SRM+1- D code, Homogeneous+1-D code
- **Detailed kinetic mechanism:** Primary reference fuel (PRF)
- **Turbulent mixing:** Curl Model
- **Accounts for internal and external EGR**
- **Stochastic heat transfer model**

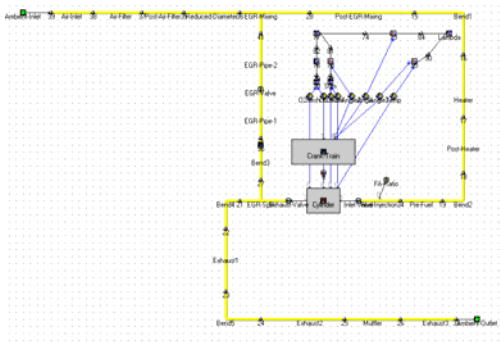
Unburned HC emissions vs. ON



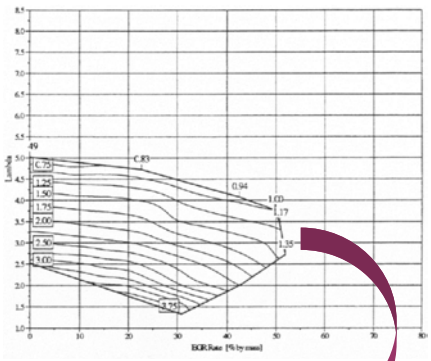
In-cylinder pressure vs. ON

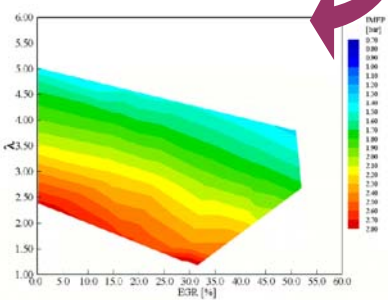


Ricardo E-6 HCCI engine



Coefficient of variation in IMEP





Conclusions

- The conjunction of stochastic reactor model with 1-D fluid dynamics, GT-Power code enabled investigating the mutual influences of the engine behaviour and combustion process.
- The integrated model is robust and correctly predicts HCCI combustion, emissions and engine performance with EGR and octane number variation.

References

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