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Performance evaluation of gasoline alternatives using a detailed thermodynamic spark-ignition engine model

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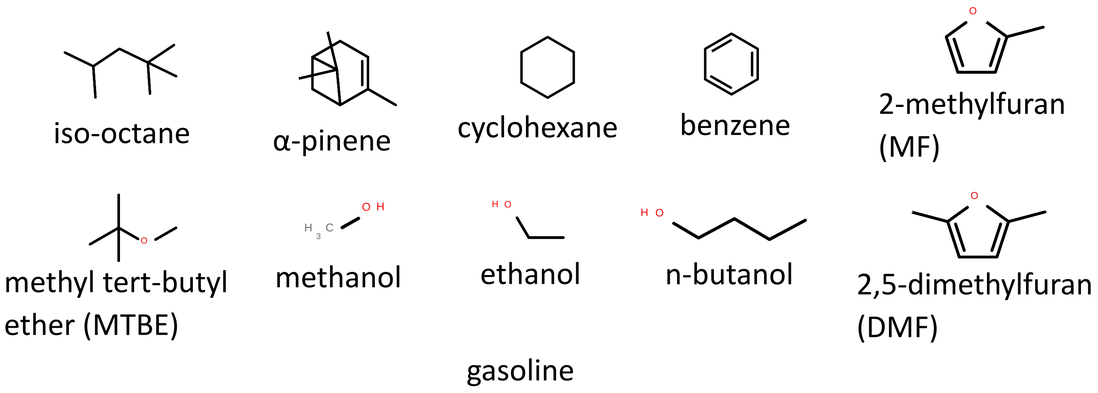
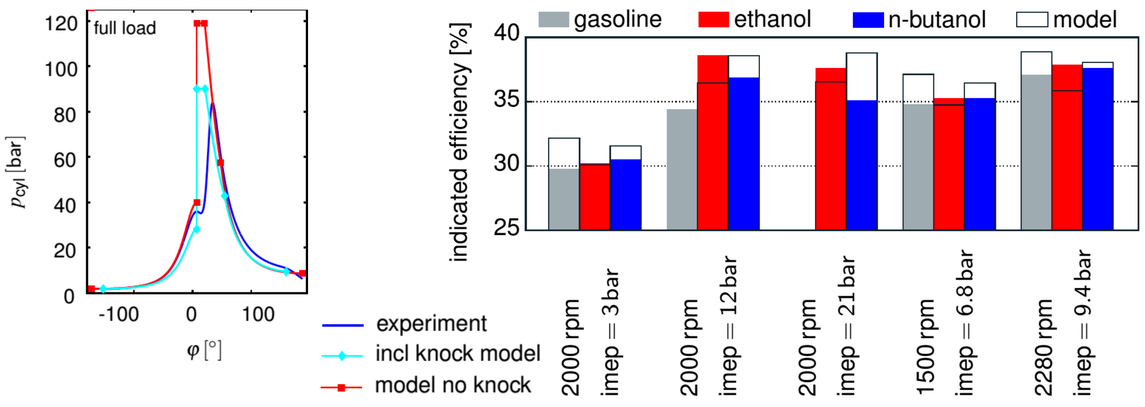
Investigated Fuels

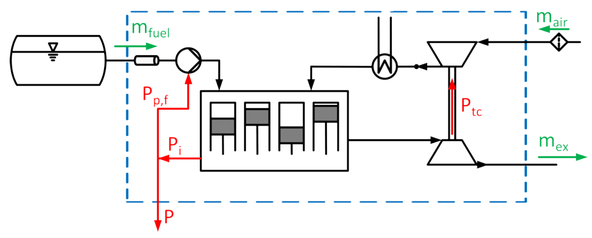


Validation[2]



Spark Ignition Internal Combustion Engine (SI ICE) Model

Overview On Modelled Engine Components[1]



- Adaptation of the compression ratio of the engine to optimize the efficiency at 2000 rpm and full load to avoid knocking

➜ Fuel is used to its full potential

Assumptions

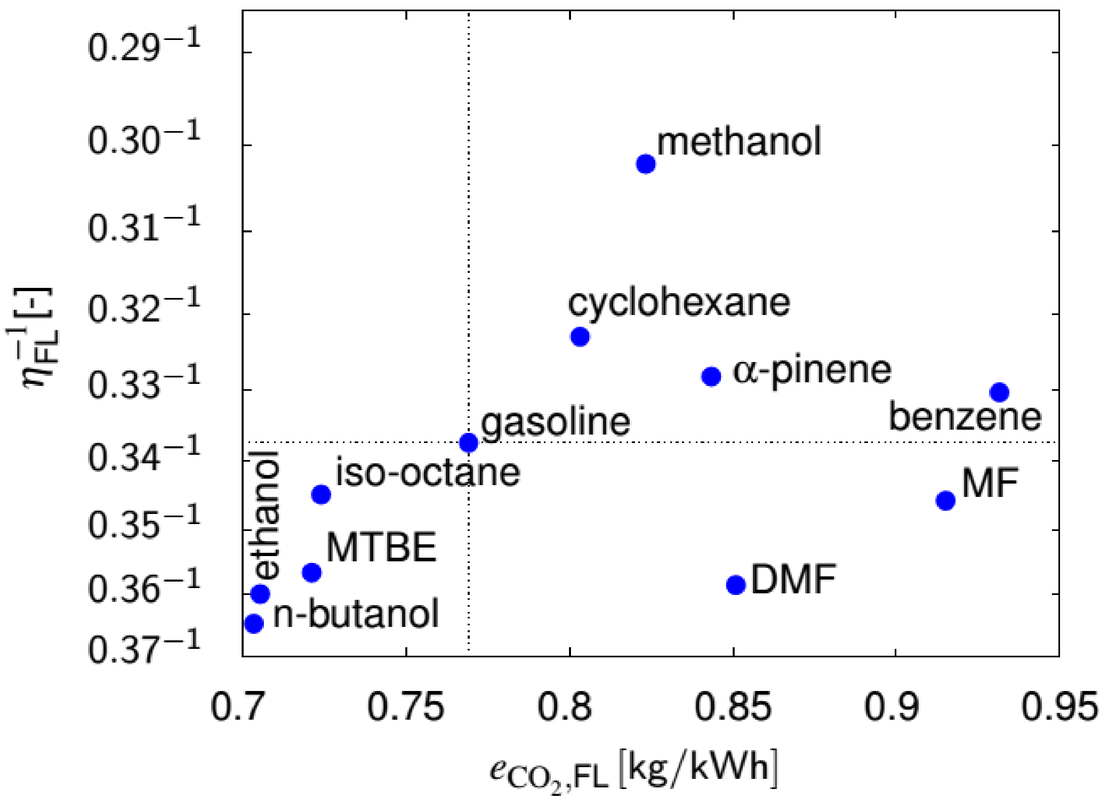
- All gases are considered ideal
- Perfect mixture of the gases, except during combustion
- Gas mixture properties depend linearly on the progress of combustion
- Engine runs in steady state, conditions before and at the end of each cycle are identical
- Gas exchange is perfect: no blow-by and no remaining unburnt gases within the cylinder

Output

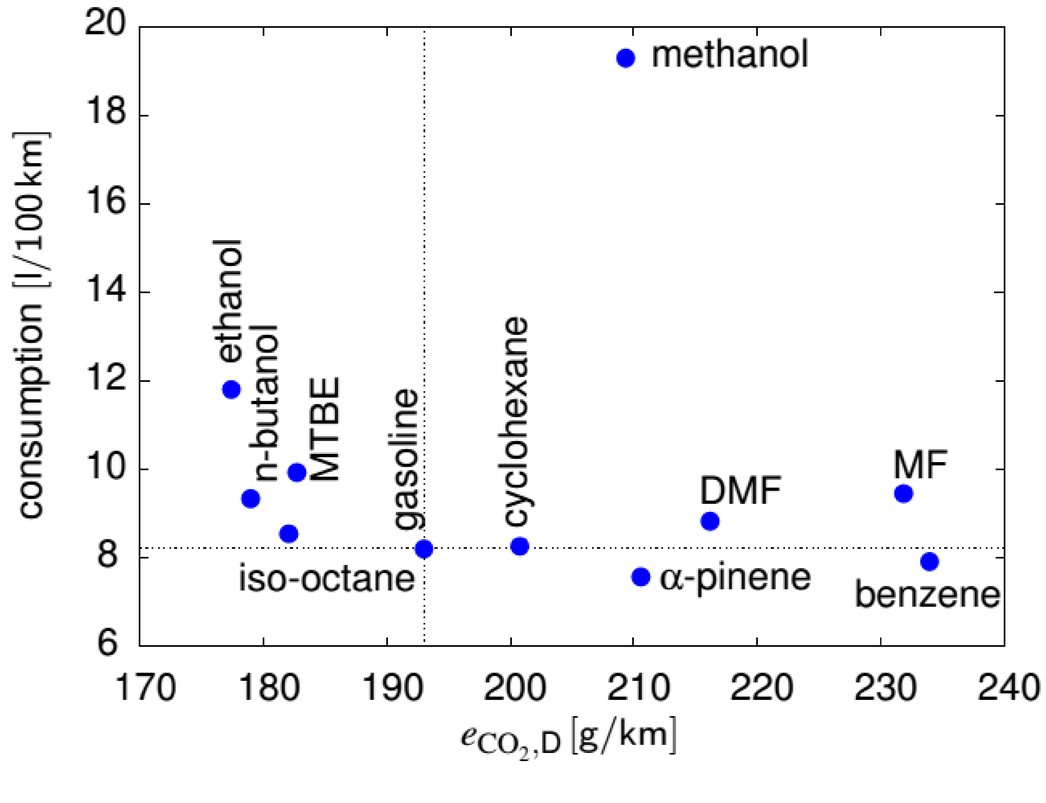
Efficiency (η), Power output (P) and CO_2 emissions (CO_2) at 2000rpm and full load

Results

2000 rpm, 2 bar charging



Worldwide Harmonized Light Vehicles Test Cycle (WLTC)



Future Work

- Setup of a server for running the model online: **http://fuel-simulation.psi.ch**
- Extend model to mixtures

Acknowledgement

- Model building: D. Wüthrich
- Programming: L. Bärtsch
- Discussion on engines and modelling: K. Boulouchos (ETHZ), C. Bach (EMPA)

References

[1] Gschwend D. et al, Sustainable Energy & Fuels, DOI: 10.1039/c7se00276a
[2] Brassat A. et al, *MTZ – Motortechnische Zeitschrift*, 2011, **72**, 988-995

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