Research Group of Thermodynamics and Internal Combustion Engines
Department of Mechanical Engineering
Aalto University, Finland

Performance of a Single-Cylinder Compression Ignition Engine

Background

Work Principle of CI Engine

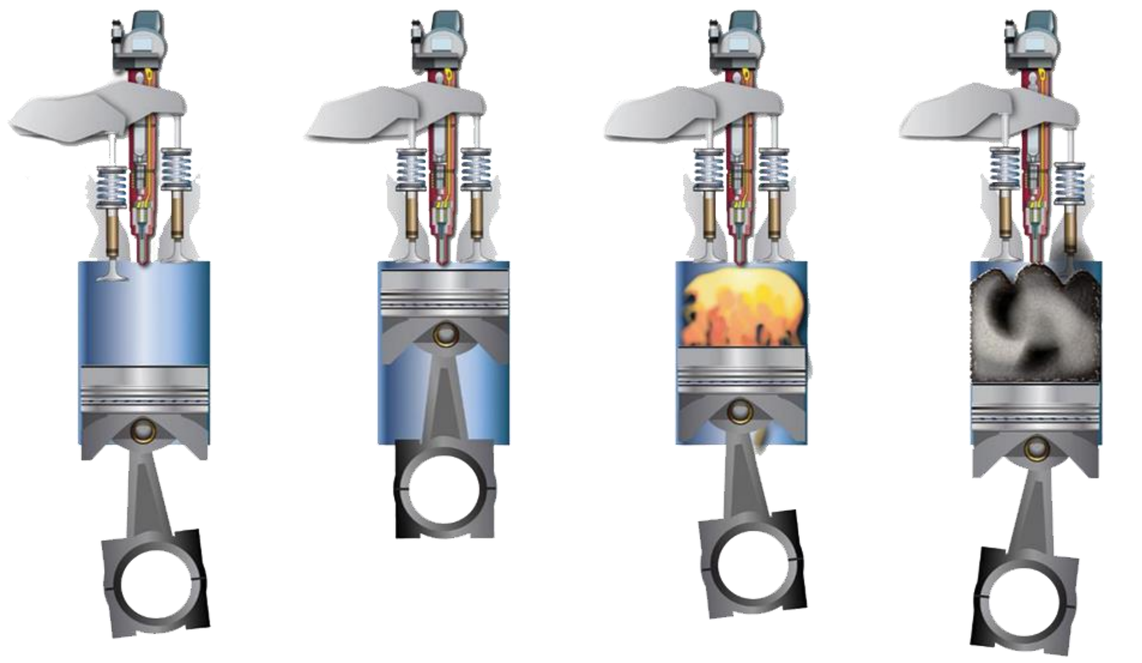

Figure 1. Work process of a four-stroke engine: intake, compression, work and exhaust

Engine modelling

Experimental Setup

Figure 2. The single-cylinder full-metal compression ignition engine at Aalto Engine Lab

Descriptions of the Engine

A special designed single-cylinder full-metal CI engine aims at investigating the engine performance by varying the different parameters. Compared to the commercial engines, this engine provides more flexible control.

Cylinder bore (mm)	**111**
Stroke (mm)	145
Total Displacement- 6-cylinder (L)	8.42
Displacement 1-cylinder (L)	1.4
Compression ratio	16.5:1
Diesel pilot injection	Bosch CRIN3-20 Common rail, direct
Methane injection	Port injection with 2 Hana injectors
Engine control	Custom made in LabVIEW environment, uses NI DRIVVEN and other NI modules

Data Acquisition and Postprocessing

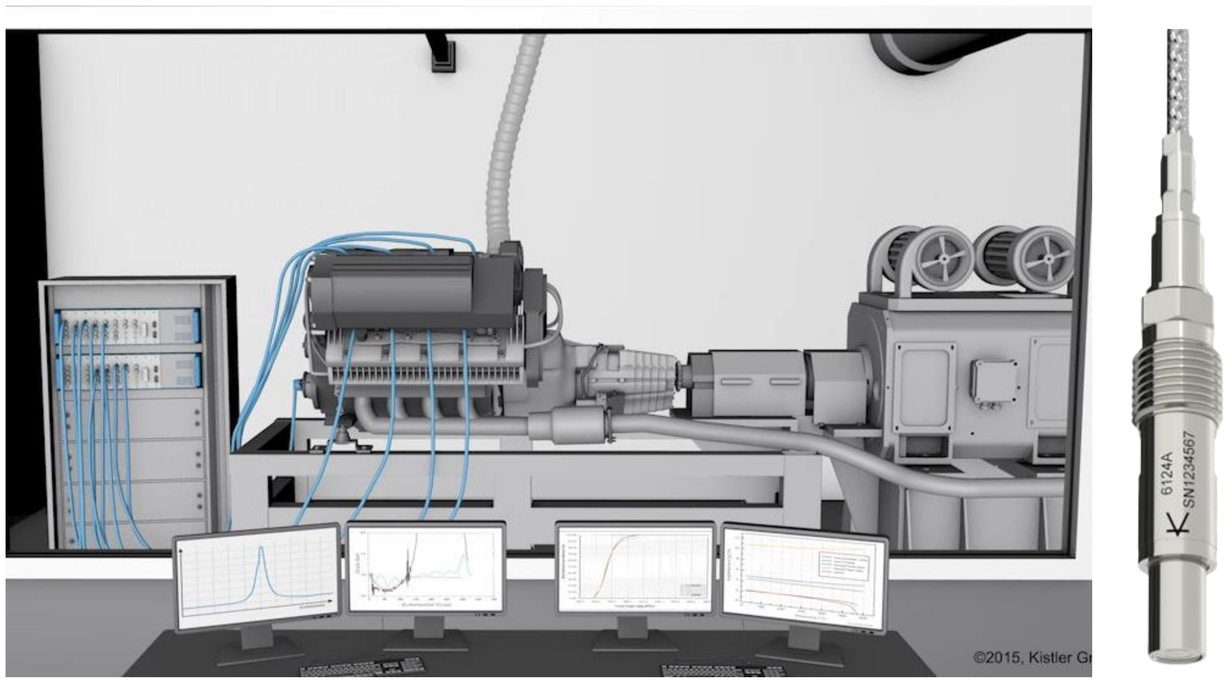

Figure 3. Typical test bench of an internal combustion engine and cylinder pressure sensor

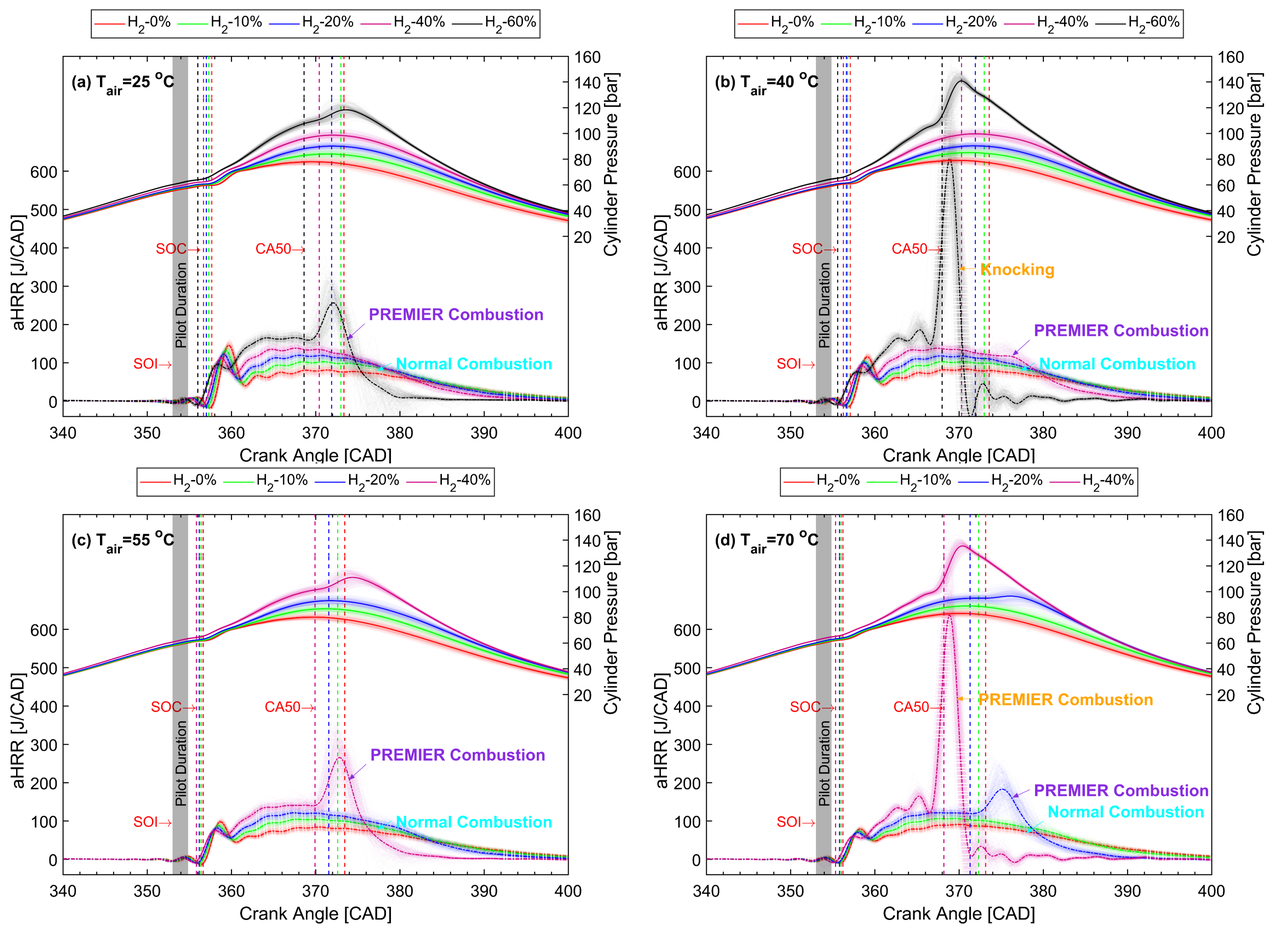

Figure 4. Data postprocessing and results plotting

Objectives and Outcomes

- You have an opportunity to operate a practical engine with various engine operating conditions.
- You will learn how to use the second law of thermodynamics to analyze the engine performance based on the cylinder pressure, e.g., heat release rate, combustion efficiency, indicated thermal efficiency, etc.
- You will learn Matlab programing to do post-processing and plot the results.
- You will learn how do the injection timing, injection duration, injection pressure, equivalence ratio and fuel properties affect the engine performance.
- After the project, you will gain more insight into the application of thermodynamics in an internal combustion engine.