University of Nottingham
UK | CHINA | MALAYSIA

Advanced Powertrain Engineering
MMME4066
Performance and Efficiency

Antonino La Rocca

Professor in Applied Thermofluids and Propulsion Systems

Coates Office C39

Email: antonino.larocca@nottingham.ac.uk

Case study – Self-study Activity 2025-26

The performance and emission characteristics of a modern three-cylinder 1l turbocharged direct injection engine are currently under investigation in the research laboratory of the Powertrain research Centre at the University of Nottingham.

The engine is operated at a steady-state operating point. The in-cylinder gas pressure, recorded from a pressure transducer installed in the combustion chamber, is measured with a ½ crank angle degree resolution;

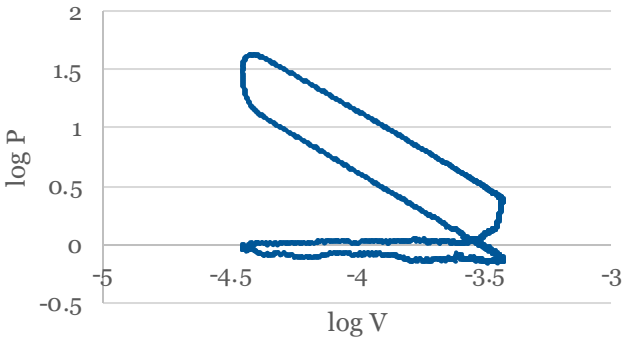
the pressure recordings are provided in an excel file uploaded on the MMME4066 Moodle page.

No lecture on 28th October. Please use the lecture time (2 hours) to complete the calculations.

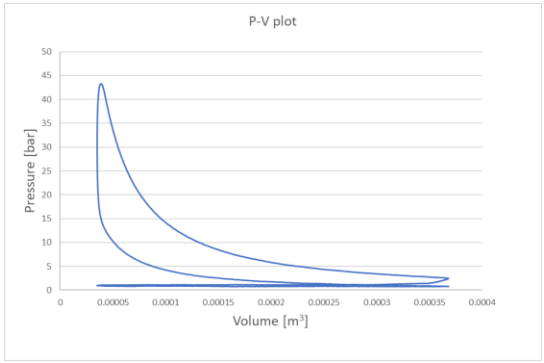
Case study – guide to solution

$$s = a\cos\vartheta + \left(l^2 - a^2\sin^2\vartheta\right)^{1/2}$$

$$V = V_c + \frac{\pi B^2}{4}\left(l + a - s\right)$$



Gamma is calculated from the p-v diagram in logarithm scale.



$$W_i = -\oint p\,dV$$

Gross indicated work per cycle (per cylinder) $\boldsymbol{W_{c,ig}}$ work delivered to piston over compression and expansion strokes only

The trapezoidal rule of numerical integration simply approximates the area by the sum of several equally spaced trapezoids under the curve between the limits

Case study

This is a self-study activity designed to be completed in the two hours allocated to the lecture scheduled for the 28th October 2025.

Calculations can be performed using Excel or Maltab. Given that you would need a PC/Laptop and lecture notes, it might be appropriate for you to complete the activity either in your room or in the library.

However, on Tuesday 28th October I will be available on Teams to answer queries and provide support. You are encouraged to work in groups.

Results and solutions will be discussed before in one of the following lectures. Please take calculations and solutions to the lecture.