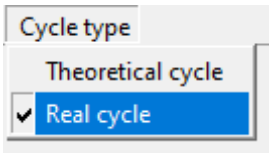
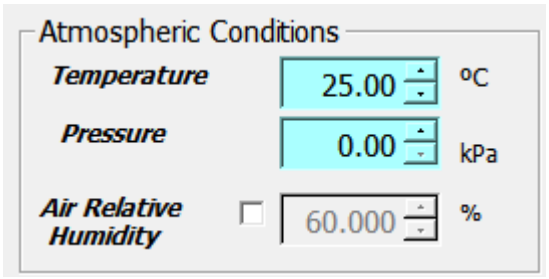
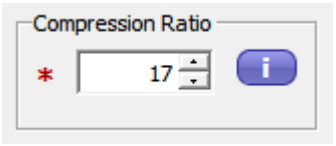
Exercise 1

This project deals with the analysis of the processes that occur in a compression ignition internal combustion engine, based on a fill-empty model. Model implemented in the ICECycles software that does not require long calculation times, which makes it a practical tool for use in classes and in the industry.

The advantages of an internal combustion engine are the use of liquid fuels with a high calorific power, giving it great autonomy, as well as acceptable thermal performance, a wide range of powers depending on its application and very varied construction arrangements. that allow the motor to be adapted to more diverse uses.

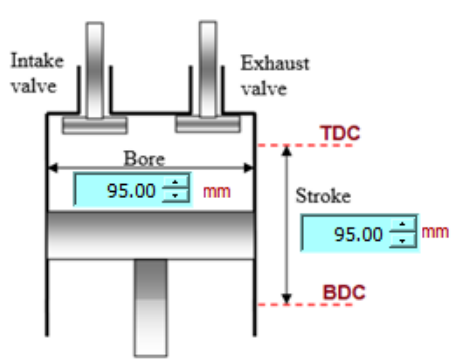


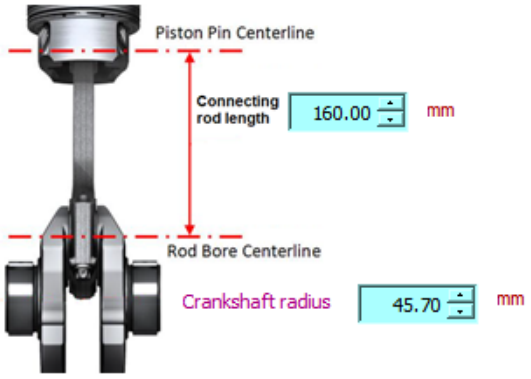




In engineering, modelling a process means using the appropriate equations and assumptions to analyse its characteristics. The modelling of processes in internal combustion engines contributes to the understanding of basic physical and chemical phenomena.
The models describe the thermodynamics, fluid flow, heat transfer, and combustion that govern aspects of engine performance. But the purpose of the models is to show how the combination of fluid dynamics, heat transfer, thermodynamics, and fundamental kinetics can predict, at various levels of sophistication and complexity, the engine combustion process and emissions. that it generates, among other things, and therefore be able to predict its general or particular operating characteristics.

Geometry parameters



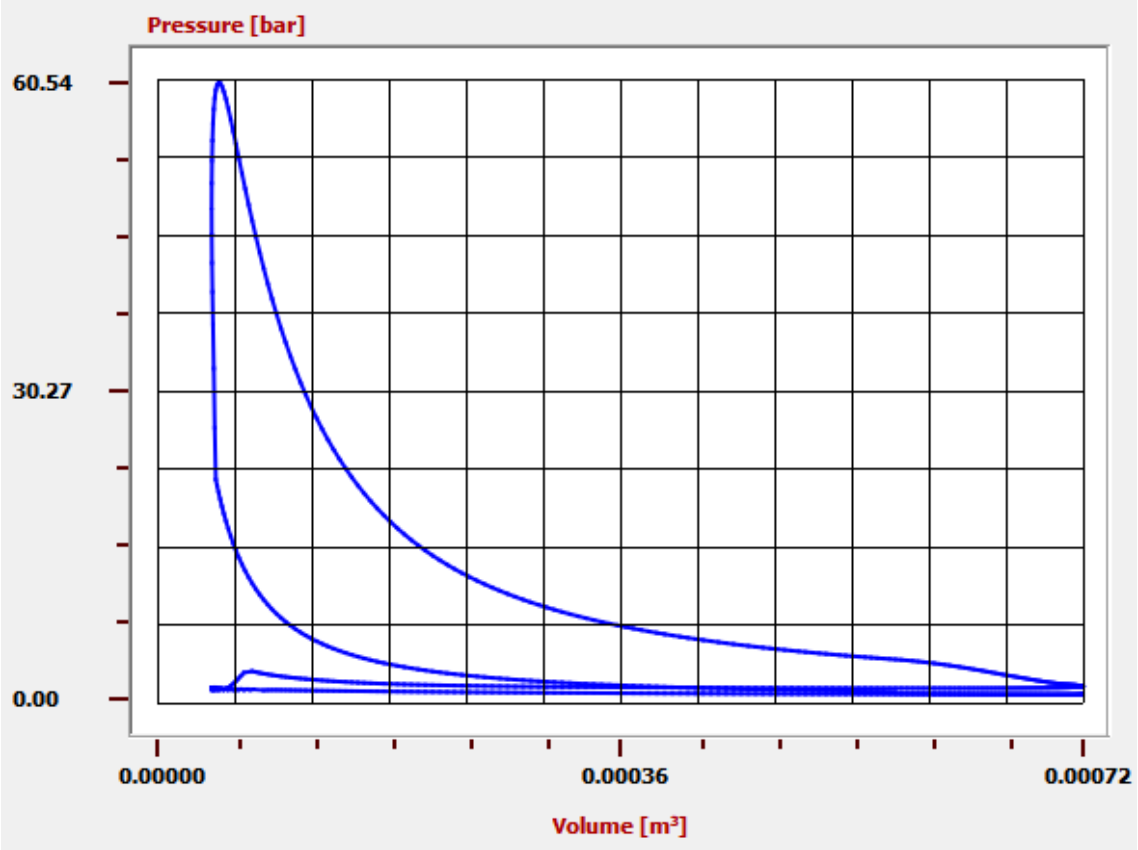


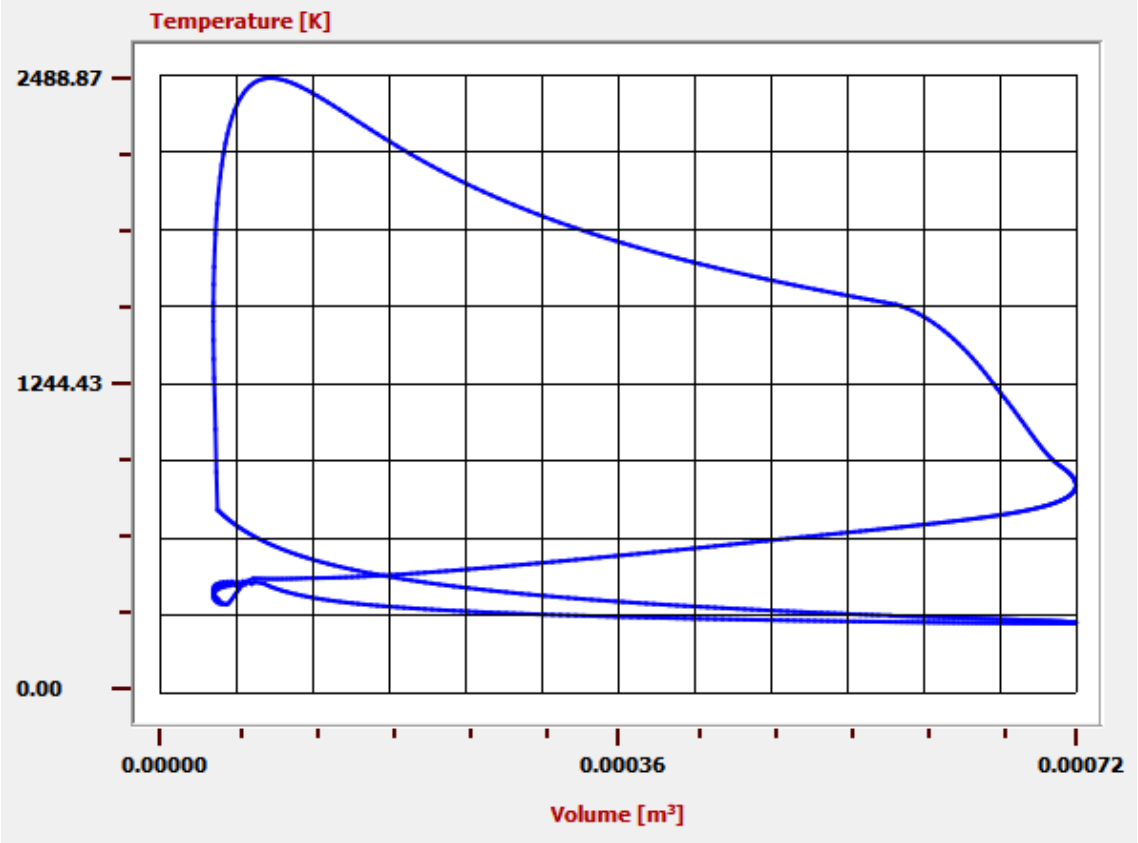
Engine valve adjustment

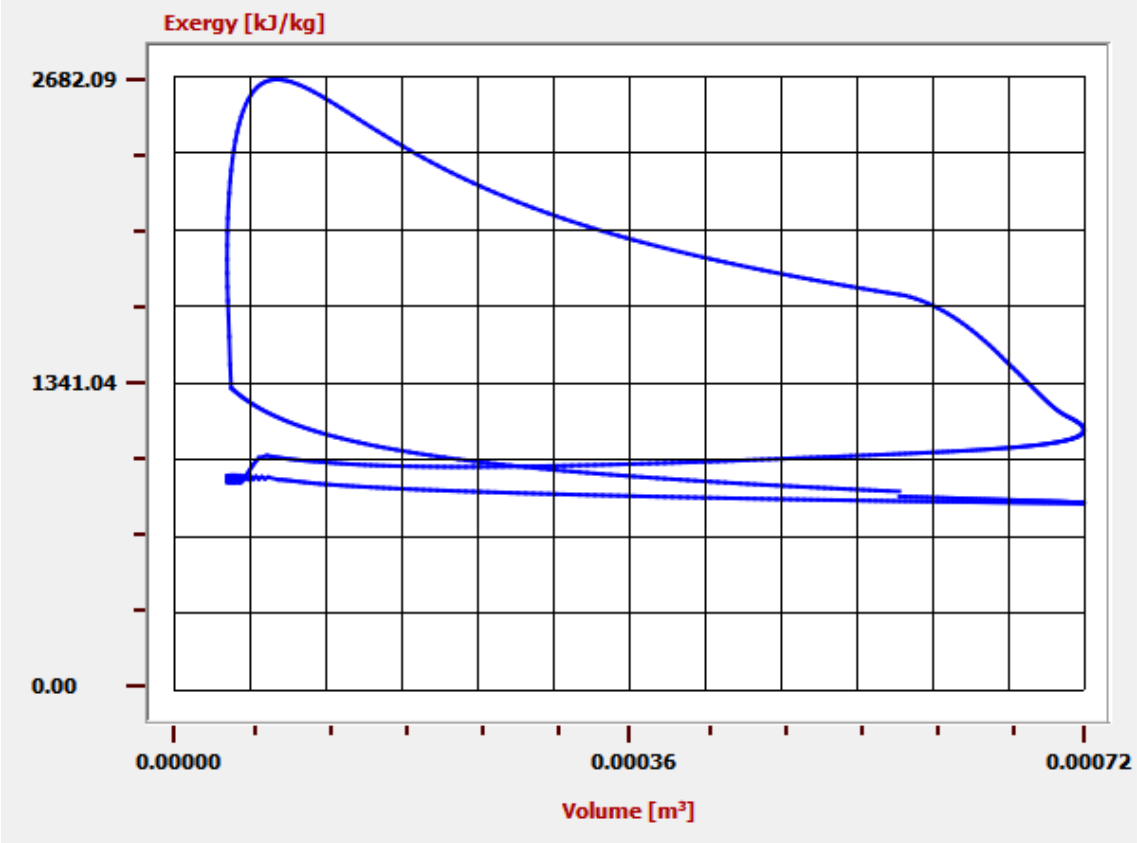
Inlet valve open, IVO	697	degree	Exhaust valve stem diameter	6.56	mm
Inlet valve close, IVC	243	degree	Exhaust seat angle	0.785398	degree
Exhaust valve open, EVO	477	degree	Exhaust valve head diameter	36.10	mm
Exhaust valve close, EVC	743	degree	Exhaust seat width	2.30	mm
			Exhaust inner seal diameter	26.30	mm
			Exhaust duct diameter	35.00	mm

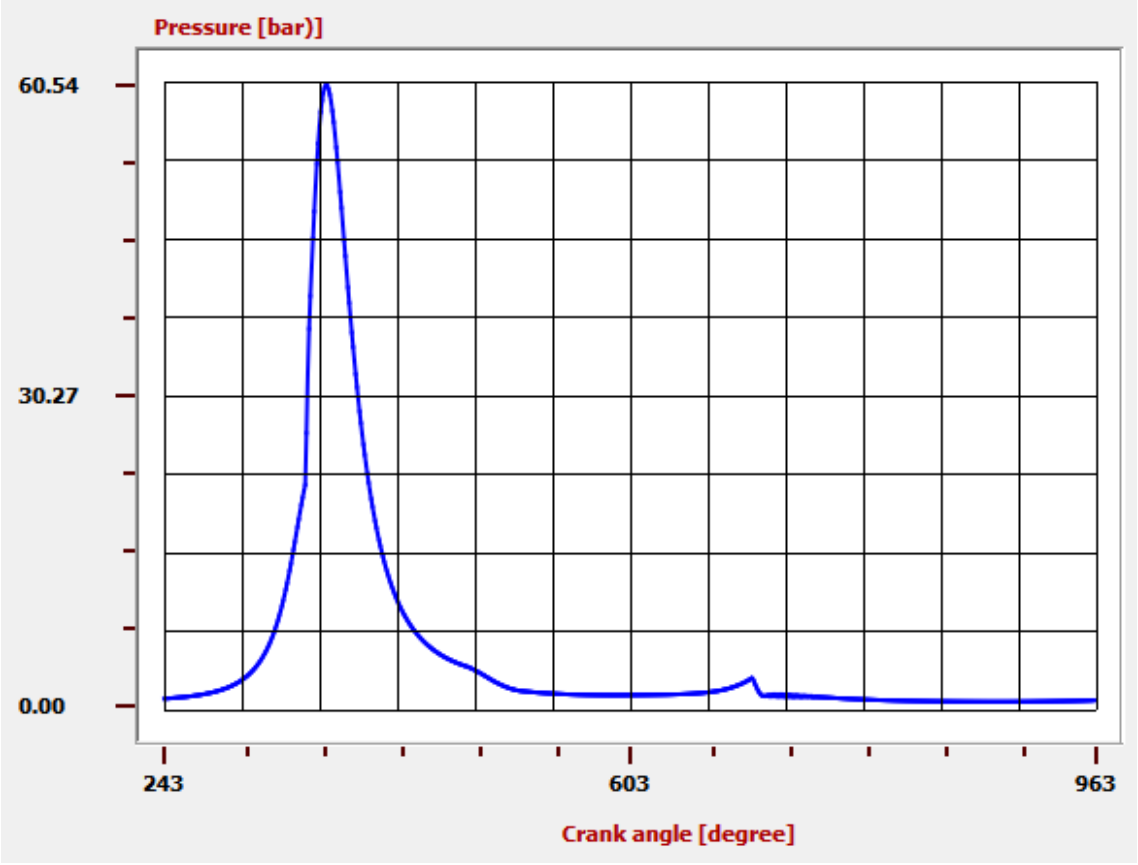
Intake valve stem diameter	7.25	mm
Intake seat angle	0.785398	degree
Intake valve head diameter	39.90	mm
Intake seat width	2.50	mm
Intake inner seal diameter	29.00	mm
Intake duct diameter	35.00	mm

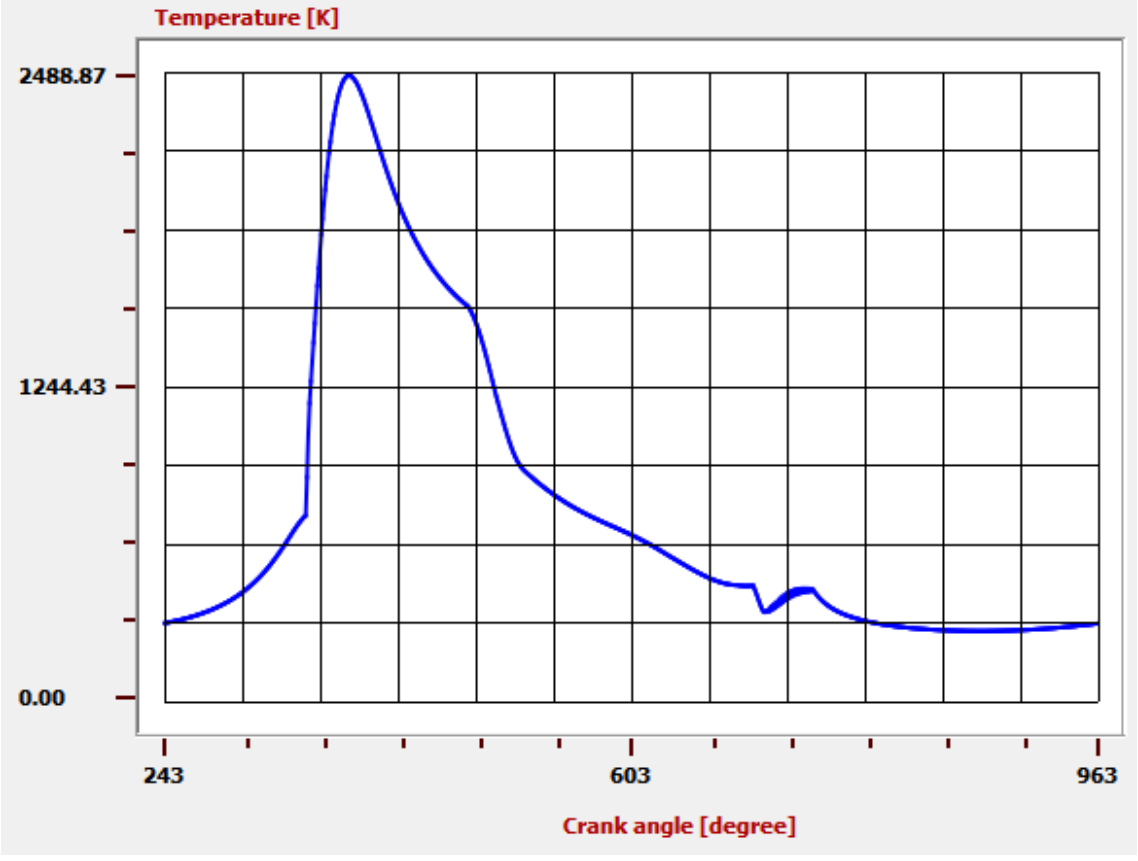
It is shown that the software itself is a useful tool in predicting the performance of an engine, with which it is possible to carry out parametric studies that allow evaluating changes and alternatives in its design, before resorting to experimentation, which is usually be expensive, testing only the most promising designs. In this way, it is possible to arrive at better prototypes from the point of view of performance and polluting emissions.

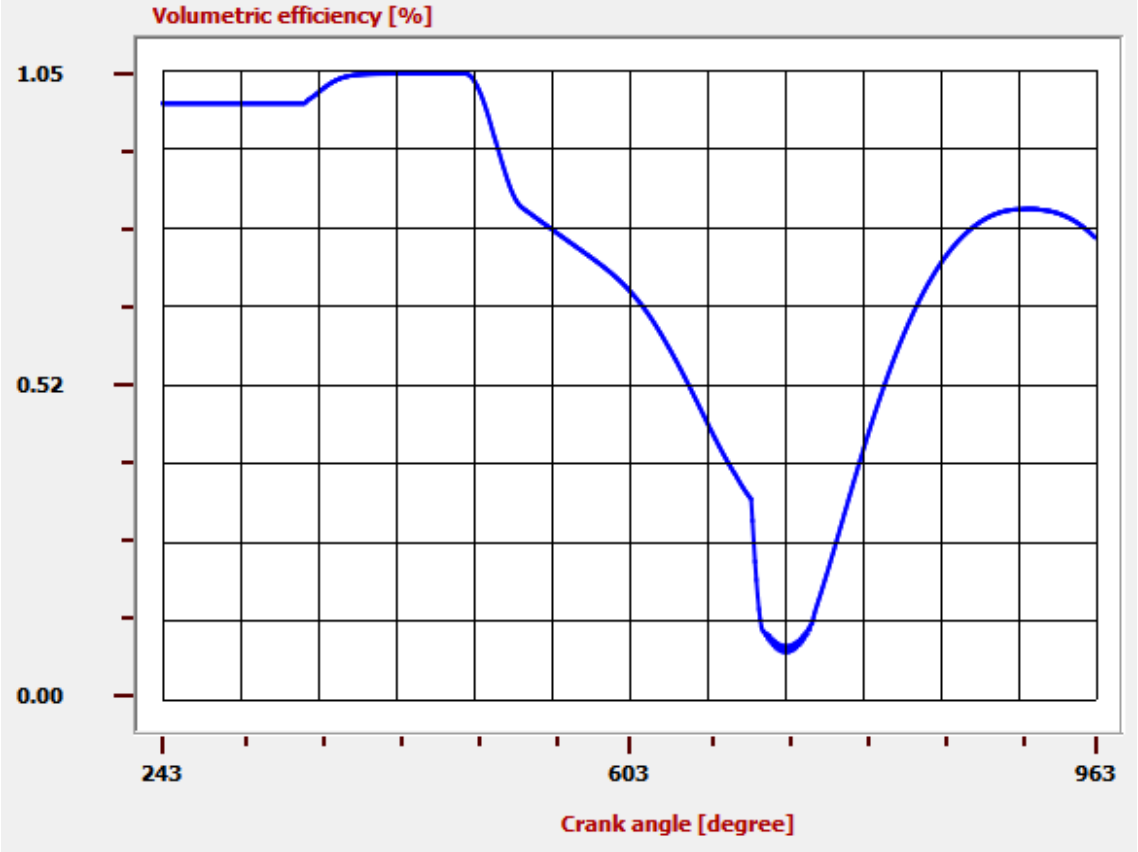


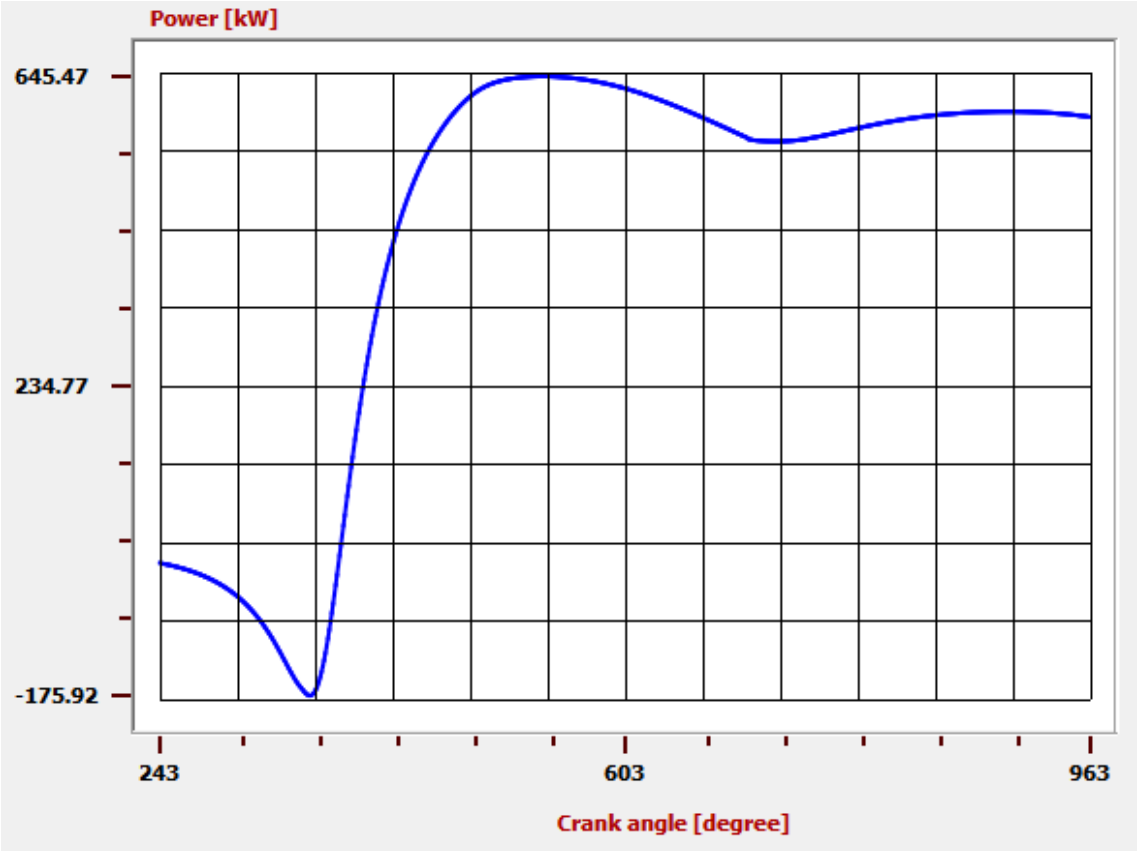

Temperature [K]
2488.87
1244.43
0.00
0.00000
0.00036
0.00072
Volume [m³]

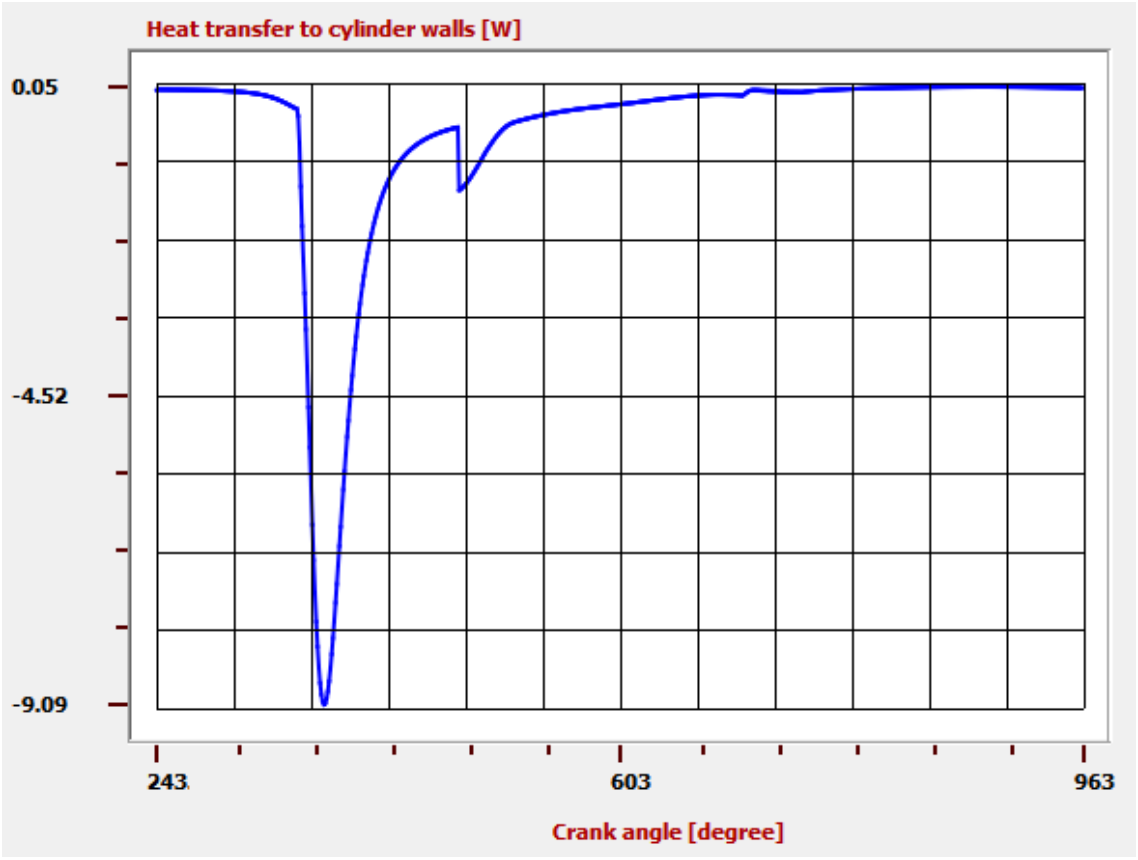

Exergy [kJ/kg]
2682.09
1341.04
0.00
0.00000
0.00036
0.00072
Volume [m³]

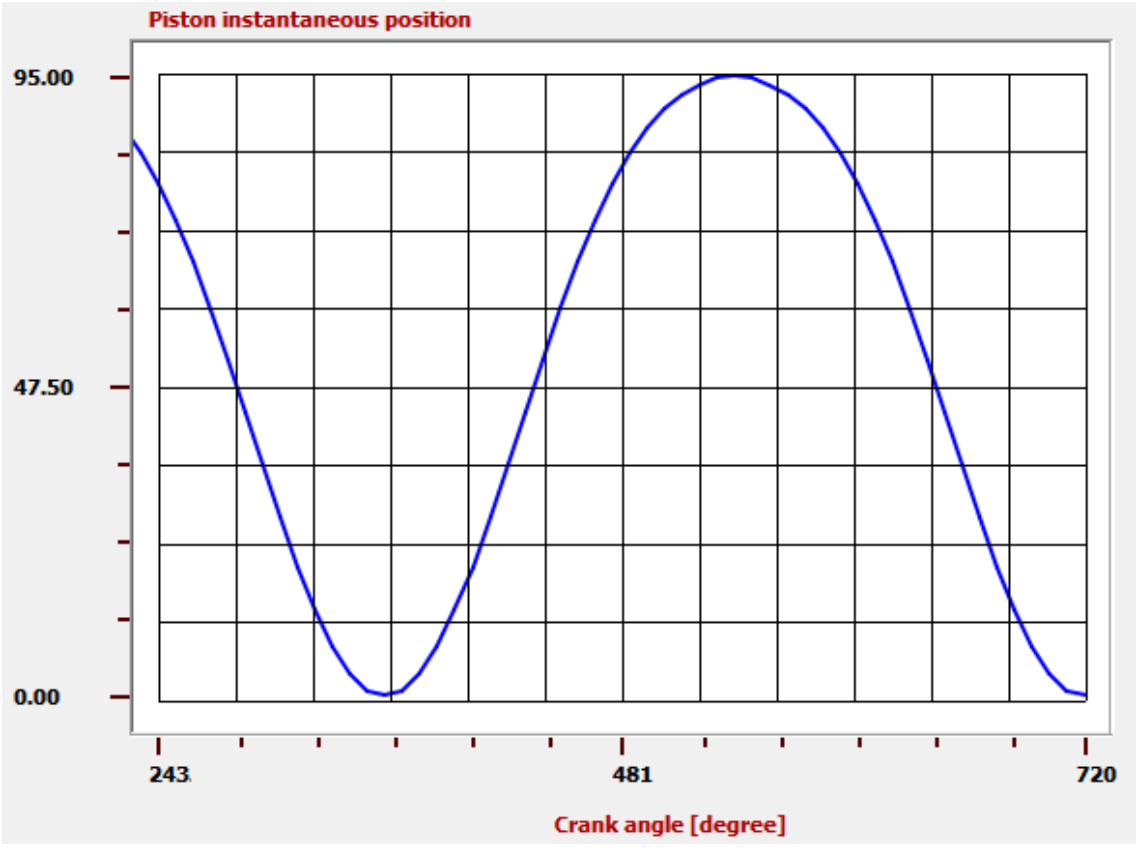

Pressure [bar)]
60.54
30.27
0.00
243
603
963
Crank angle [degree]

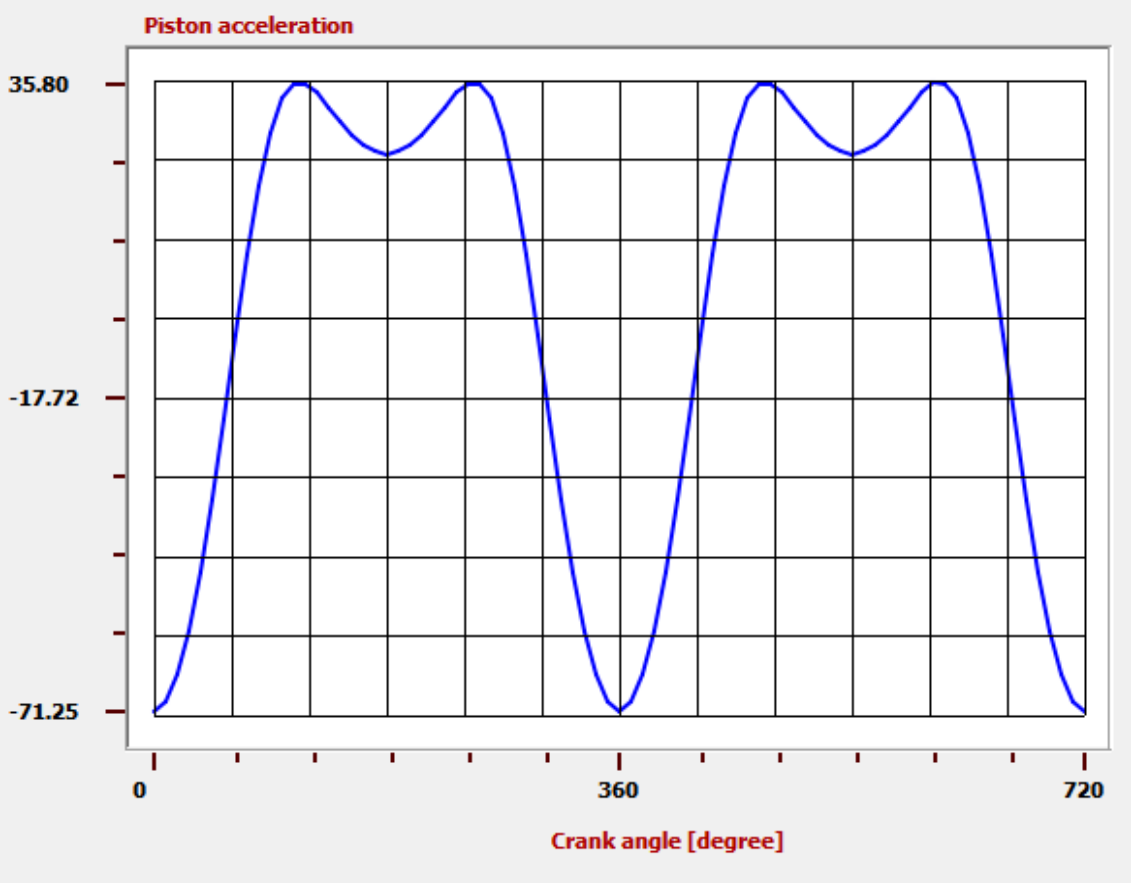

Temperature [K]
2488.87
1244.43
0.00
243
603
963
Crank angle [degree]


Volumetric efficiency [%]
1.05
0.52
0.00
243
603
963
Crank angle [degree]


Power [kW]
645.47
234.77
-175.92
243
603
963
Crank angle [degree]


Heat transfer to cylinder walls [W]
0.05
-4.52
-9.09
243
603
963
Crank angle [degree]


Piston instantaneous position
95.00
47.50
0.00
243
481
720
Crank angle [degree]



The software can be used in undergraduate and postgraduate courses dealing with the subject of internal combustion engines and will allow students to quickly and illustratively analyze the impact on engine performance that certain changes in its design or engine would have. its operating parameters. It can also be used in research projects for these same purposes.