Low-pressure Exhaust Gas Recirculation transients in automotive diesel engines.

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Introduction

The development of current diesel engines is focused on lowering fuel consumption and pollutant exhaust emissions. LP EGR is a technique to reduce NOx emissions. New homologation cycles will be more restrictive including transient operation. For that reason it is necessary to improve the control of LP-EGR transport in the intake line in these conditions.

Methodology

To evaluate the transport of exhaust gases in the intake line a CO2 fast tracking system is used.

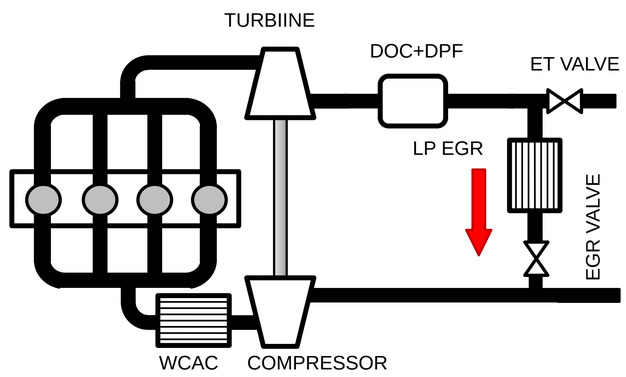
Three different transient tests are analyzed:

2 bar BMEP → Full load

Full load → 2 bar BMEP

2 bar BMEP → 11 bar BMEP

Modelling tools are used in combination with the experimental tests. 1D engine simulations are performed with OpenWAM software in order to evaluate the prediction of exhaust gases behaviour inside the intake line during transient conditions.

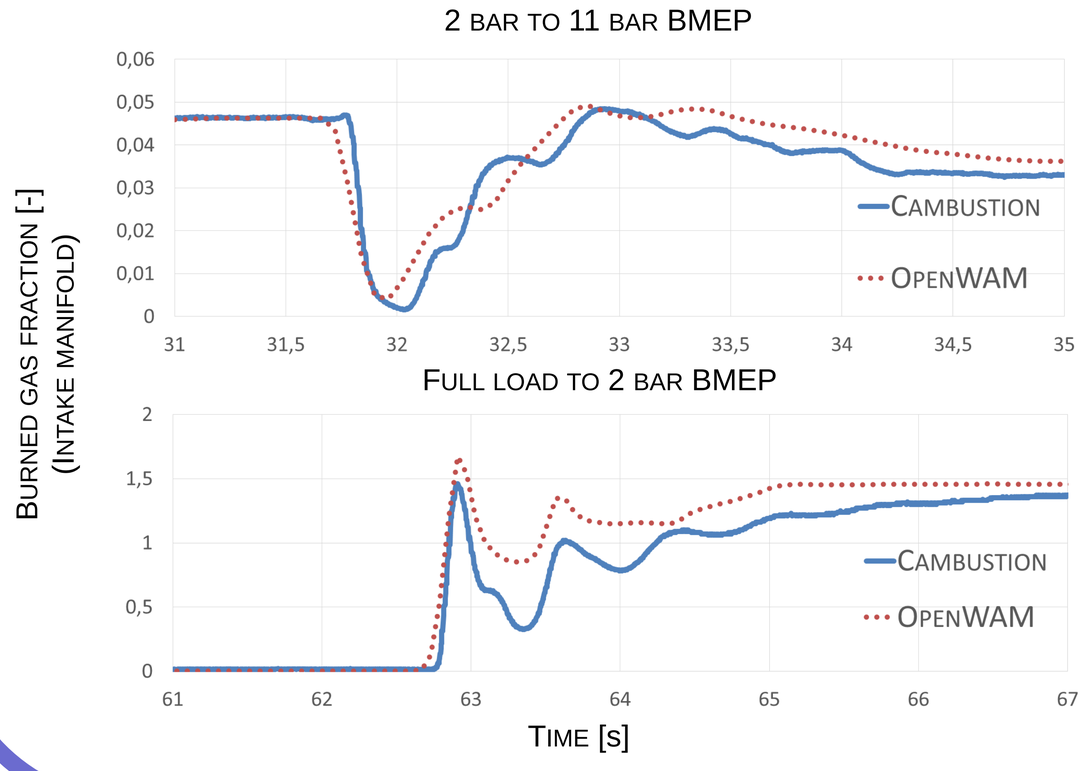


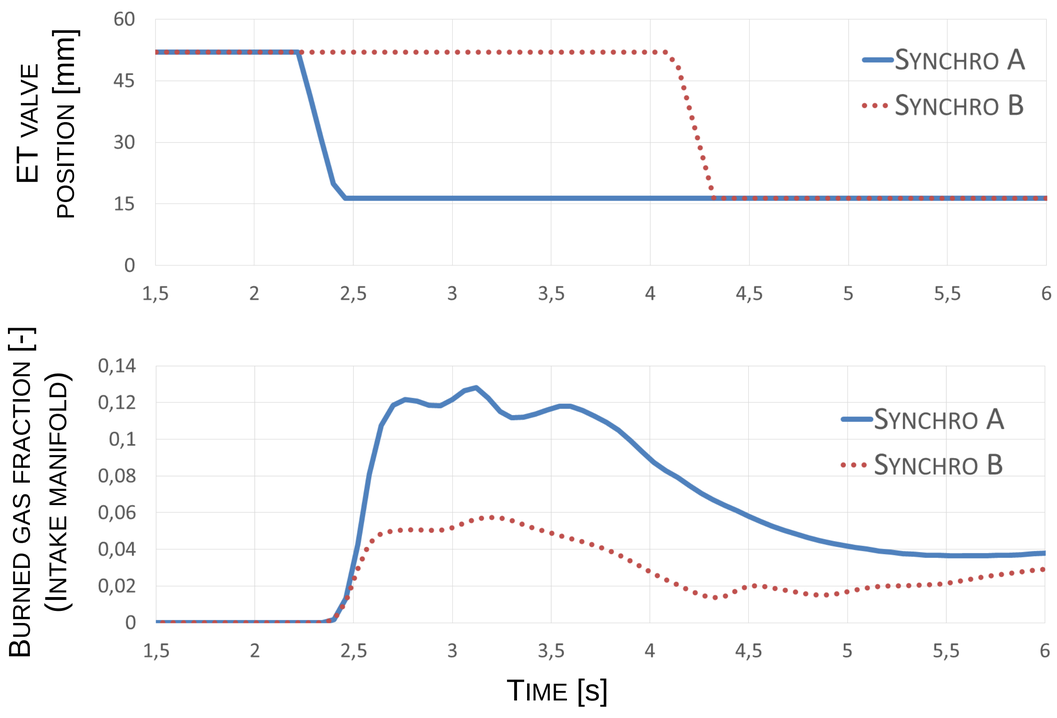
Results

Calculated and experimental results are very similar.

The immediate response of the Cambustion© system is observed.

An overshoot effect is observed and it could be reduced with an adequate synchronization of the EGR and ET valves.





Conclusions

Cambustion© system is essential to perform this kind of studies.

1D model performed with OpenWAM software is valid for all of cases carried out because the predicted evolution of the EGR is very similar to reality.

Two valves (EGR and ET) are necessary to achieve the EGR rate required in steady state conditions.

The synchronization of the EGR and ET valves is very important in transient conditions, for example, to avoid or reduce the overshoot effect.