

# Simulating IC engines: From fuels to engine-out and tailpipe emissions



*SRM Engine Suite integrated with a commercial 1D engine cycle simulator to model engine-out and tailpipe emissions as a function of fuel, combustion mode and after-treatment*

## THE CHALLENGE

Accounting for the effect of fuels and combustion modes on engine-out and tail-pipe emissions in internal combustion engines.

## THE SOLUTION

Applying the physico-chemical SRM Engine Suite software coupled with a 1D engine cycle simulator to model the fuel oxidation, combustion, engine-out and tailpipe emissions

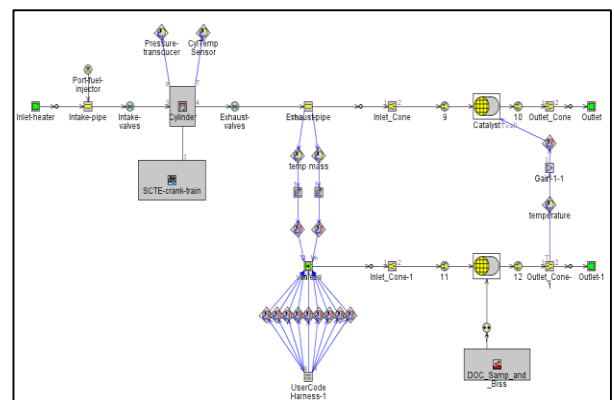
## THE RESULTS

- Engine-out and tailpipe emissions as a **function** of fuel, combustion mode, and exhaust after-treatment (EAT) configuration
- SRM Engine Suite software coupled with a 1D engine cycle simulator
- Capability to model conventional and alternative fuels via chemical kinetic schemes for fuel oxidation and emissions pathways

## OVERVIEW

The probability density function (PDF)-based Stochastic Reactor Model (SRM) Engine Suite was applied as a co-simulator within a 1D engine cycle model to simulate the entire chain, i.e. from a fuel model (in this case a Diesel fuel), through to engine-out and tailpipe emissions in a compression ignition direct injection (CIDI) engine.

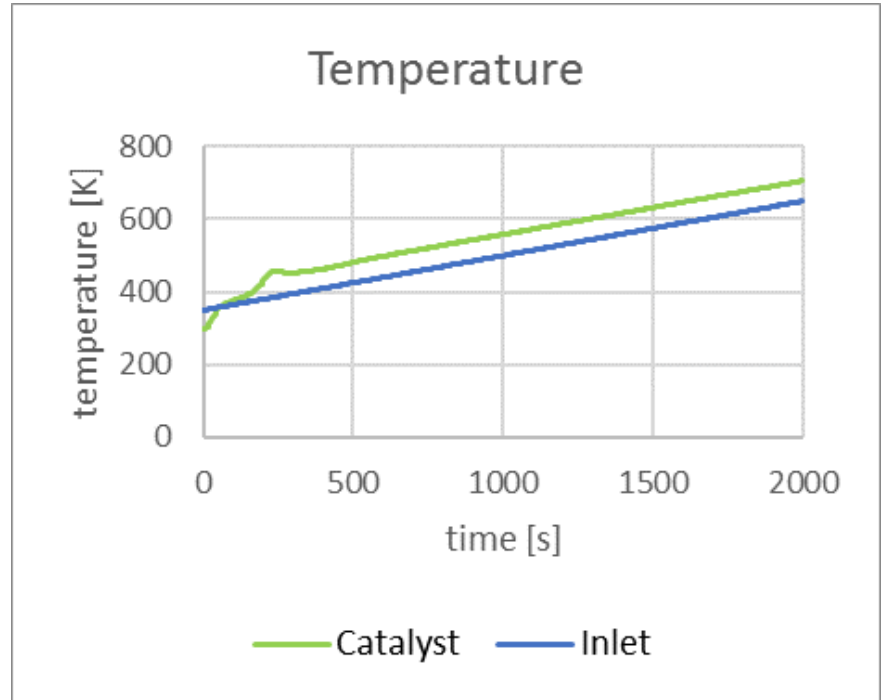
Once the flow calculated with the 1D engine cycle code was stabilised, the SRM Engine Suite was used to compute the detailed chemical kinetics from combustion and employed to provide a realistic set of input species to the aftertreatment model.



SRM Engine Suite coupled with a 1D engine cycle simulator: Fuel to tailpipe

## WORKFLOW

1. Set the coupled SRM Engine Suite with the 1D engine cycle simulator.
2. The output ensemble averaged species composition representing the engine-out is supplied to the exhaust after-treatment model as an initial condition.
3. The average gas temperature and the species concentration profiles are provided as a function of time.



**Above:** Evolution of gas temperature at the inlet and within the DOC.

**Below:** Evolution of CO, CO<sub>2</sub>, NO and N<sub>2</sub> mole fraction at engine-out and tailpipe.

## APPLICATION AREAS

- IC engines
- Engine-out emissions
- Tailpipe emissions

## PRODUCTS USED

- SRM Engine Suite
- Chemical model for Diesel oxidation, soot and NO<sub>x</sub>
- 1D engine cycle simulator

