New Combustion Systems in Spark Ignited Engines

3 days **MOT/COMBE-E**

Overview

LEVEL

Expert

PURPOSE

This course provides an understanding direct or indirect injection SI engines: the physics of the mixture preparation, of the combustion and of the pollutants formation; as well as the influence of the engine setting parameters.

LEARNING OBJECTIVES

Upon completion of the course, participants will be able to:

organize a series of tests,

analyze the results in order to optimize combustion,

know the evolution trends for the next 5 years.

WAYS AND MEANS

Interactive talks.

Many "up-to-date" examples and combustion videos.

PREREQUISITES

IC engines fundamentals.

Agenda

CURRENT TECHNOLOGIES & ASSOCIATED COMBUSTION SYSTEMS — 0.75 d

Regulations: CO_2, particles, WLTP.
Current engine technologies, associated combustion systems, indirect injection (GII), direct injection (GDI), central jet spray, side jet spray, homogeneous combustion, stratified combustion, CAI.
Impact of air loops, variable timing.

GENERIC APPROACH OF COMBUSTION SYSTEMS (GII & GDI) — 0.25 d

Normal combustions: turbulence, thermodynamical conditions, spark ignition.
Abnormal combustions: knocking, rumble, superknocking, …
Valve timing, impact on combustion.

COMBUSTION SYSTEM DESIGN WITH INDIRECT INJECTION (GII) — 1 d

Combustion chamber shape, ports design, injector targeting, rail pressure.
Warm phase combustion.
Cold phase combustion.

COMBUSTION SYSTEM DESIGN WITH HOMOGENEOUS DIRECT INJECTION LAMBDA = 1 — 0.5 d

Central jet spray, side jet spray, combustion chamber shape.
Injector targeting.
Injection system, injection strategies, multiple injections.

Particles, dilution.
Warm phase combustion.
Cold phase combustion.

TECHNICAL EVOLUTIONS

0.5 d

Impact of combustion optimizing on architecture choice: 2, 3, 4 cylinders.
International context (RON, intake spoiling, flex-fuel, …).
Technical evolution in 2020 view.