Virtual Classroom - This course is available in face-to-face mode

Engine Management Training - Remote training

30 days **HECTRLM-EN-D**

Overview

LEVEL

Expert

PURPOSE

This course provides engineers with a deeper knowledge on the engine operating physics and the engine electronic control in order to take part in the development of control and calibration strategies on a Dyno test bench and on a vehicle.

LEARNING OBJECTIVES

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

know the parameters used to characterize and control performances, efficiency, combustion, emissions,

know the combustion mechanisms and how the exhaust gas after-treatment systems work,

know the architecture and the functions of the engine control systems, the sensors and the actuators,

have some basic practical knowledge on applied automatics to engine control,

describe the advantages and the make-up of a torque structure,

tune up the control strategies of gasoline and Diesel engines, possibly associated to an automatic transmission,

implement of the diagnostic functions, both from regulatory and operating safety standpoints,

know how to build a control law,

do the tuning and calibration process on an engine.

WAYS AND MEANS

Fully detailed training with applied exercises.

Basic simulation may be used.

Agenda

ENGINE OPERATING & TECHNOLOGY — 13 d

Thermodynamic cycles, engine general architecture, technology of the different components.
Geometric parameters, effective and shown performances parameters, efficiency, emissions, air loading parameters.
Engine mechanics: stress transmission, rotating and alternative masses balancing, acyclisms, vibrations.
Combustion in spark ignition engines and in compression ignition engines: pollutants formation, normal and abnormal combustion.
Control parameters: airflow, fuel flow, intake temperature and pressure, residual burnt gas, ignition or injection advance. How changing these parameters (motorized throttle intake exhaust gas recirculation, gasoline and Diesel fuel injection systems, variable timing, turbocharging).
Fuels: characteristics, influence on engine operation.
Exhaust gas after-treatment systems: catalysts, filters, traps; trap bleeding and filter regeneration systems; control strategies of these systems.

ENGINE MANAGEMENT — 17 d

Hardware:

Electronic control system architecture, data exchanges, development process.
Technical definition, properties and use of sensors (flow rate, speed, position, pressure, temperature, oxygen probe) and of actuators (injectors, motorized throttle, EGR valves, ignition).
Software:
Applied automatics to engine control. IPD regulation. Bode and Nyquist plots.
Torque structure. Slow and fast control. Development of a control law on the example of idle speed regulation on a gasoline engine.
Gasoline engines control strategy: architecture, synchronization, air loop, fuel injection, air/fuel ratio regulation, ignition advance, anti-knock correction, canister bleeding, catalyst actuation.
Diesel engines control strategy: rail pressure, injected flow, multi-injections, correction of dispersions, unbalances between injectors, drifts, supercharging, EGR, after-treatment.
Control in the case of automatic transmission: shift laws, interference with torque structure.
Diagnostic: EOBD regulation, operation safety; loop difference.
Statistical analysis, failures, torque structure monitoring, degraded modes. Roles and development process.