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SPRAY MOMENTUM



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INJECTORS

Nozzle geometry plays a fundamental role in order to abide by the more and more stringent legislation for engine emissions due its influence on: internal flow, cavitation phenomenon, spray characteristics and therefore the atomization process. All the mentioned factors are significant for both engine performance and pollutant emissions. By simultaneously determining Spray Momentum flux and mass flow rate, it is possible to calculate the velocity in the outlet section of the nozzle hole. Spray Momentum measuring allow to calculate several key parameters of a spray: Maximum Momentum, Max Atomization, Distance of max atomization, Direction of jet axis and Tip speed of jet.

THE SYSTEM

The Spray Momentum test bench allows to determine the impact force of the spray on a surface. This force is measured by a piezo-electric sensor, placed in proximity of the injector holes and calibrated in order to measure force.

Due to momentum conservation, the force measured by the sensor is the same as the momentum flux at the hole outlet since the pressure inside the chamber is constant and surrounds the entire spray and fuel deflected is perpendicular to the axis direction.

Definitions

- z = jet axis
- ϕ = injection angle
- θ = jet angle

Measurement Range

- Δz from 5 to 80 mm
- $\Delta\phi$ rotation of 90 °
- $\Delta\theta$ rotation of 360 °

Accuracy of the position of the sensor

- $\Delta z = 0.1$ mm
- $\Delta\phi = 0.1$ °
- $\Delta\theta = 0.1$ °

Counter-Pressure: -0.8 to 80 bar

Rail Pressure: 200 - 3000 bar

Injection frequency: up to 5Hz

The characteristics of the force sensor are:

- > Measuring range of the total force 0 - 20 N
- > Uncertainty of the measure +/- 1% of reading value
- > Repeatability of the measurement on 1 point of the measurement +/- 0.1%
- > Thermal shift : <0.5%, 35°C
- Resonance frequency >30 kHz

ADVANTAGES

The system is able to perform both global or local analysis scanning the distribution of the spray momentum along the spray section.

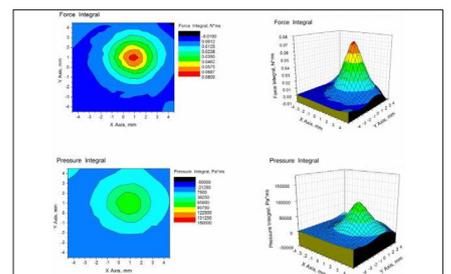
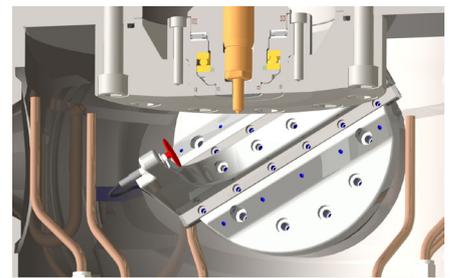
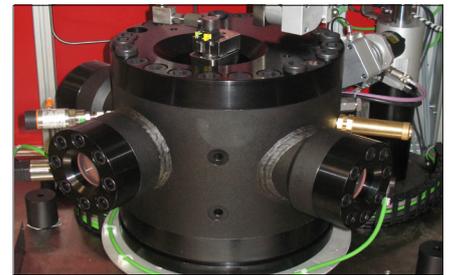
The software shall allow the operator to control all the injection parameters (Freq., Ton, Inlet Pressure) and to acquire the spray momentum at different position from the tip of injection.

Before starting a test the operator will select the type of measure (global or local) and all the necessary parameters (Z step, Number of jets, N° of acquisitions...).

After this procedure, the test will be carried out automatically.

To carry out analysis on the different jets of the nozzle, the orientation (angular position) of the injector along its axial axis is automatically adjusted (by means of the step motor and the encoder).

After the analysis of all the images acquired the software will calculate also the statistical parameters of the calculated data.



Example of local measurements map