ABSTRACT

The design of efficient and low-emissions diesel engines is increasingly dependent upon the fidelity of numerical simulation models, including those describing the fuel spray process. Following the injection event, the subsequent mixing of the fuel jet with air plays a deterministic role in the subsequent combustion and emissions formation. Accurate spray modeling requires precise knowledge of the characteristics of the injection process, and the metrics used to characterize the injection event are the area and velocity coefficients [1]. Through application of first principles (conservation of momentum), this project will result in an experimental setup to empirically determine these critical injection constants that will increase the accuracy of engine combustion simulation models. A piezo-electric pressure transducer will be used to measure the resulting force produced by an injector fuel jet, from which the above constants will be determined.

OBJECTIVES

- Design a fixture to secure a diesel fuel injector and pressure transducer in an orientation such that the fuel jet impinges on the transducer, with the axis of the jet normal to the sensor.
- Conduct experiments using a piezo injector over a range of injection pressures, measuring the forces produced by the jets of this injector.
- Perform data analysis to determine injection coefficients.

FIXTURE DESIGN

INJECTION COEFFICIENTS

- Velocity coefficient, \( C_v = \frac{u_{th}}{u_{th} A_P} \)
- Area coefficient, \( C_a = \frac{A_{geo} m_{fuel}}{A_{geo} \sqrt{2 \rho \Delta P}} \)
- Discharge coefficient, \( C_d = C_v C_a \)

NEXT STEPS

- Perform a calibration procedure on the pressure transducer.
- Set up a data acquisition system or oscilloscope to record pressure transducer output.
- Analyze data obtained from pressure transducer to determine injection coefficients.

REFERENCES


