MECHANICAL ENGINEERING MSc STUDENT SEMINAR

Wednesday, October 19 2022 at 13:00
Online: https://technion.zoom.us/j/99795710254

A Novel Direct Gaseous Reformate Injector – Design and Experimental Study

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Recent developments in High-Pressure Thermochemical Recuperation technology in the Technion – Israel institute of Technology, were first to allow engines to work on a hydrogen-rich reformate as a stand-alone fuel by its direct injection (DI) to the combustion chamber. This was achieved by using a Magneti Marelli gasoline direct injector, IHP072, modified to enable the gaseous reformate injection. However, this injector suffered from a low flow cross section, non-reliable closure and a non-optimized jet structure, which had a detrimental effect on engine performance. In order to optimize engine performance, i.e. to achieve higher flow rate, shorter open-close timing and higher backward pressure resistance (in the cylinder), an improved injector is needed. In the present work, a novel DI injector was designed producing underexpanded reformate jet.

One of the main features of the new injector is an outward-opening valve (POPPET valve) with a relatively high flow cross section. Furthermore, several elements have been incorporated in the injector design to allow rapid and convenient calibration of the valve lift, sealing force and the magnetic force. Those in turn, enable optimized injector configuration that is well-suited for different working conditions (such as different in-line pressure or flow rates).

After completing the new Injector design and production, validity tests were conducted to ensure meeting the design requirements, e.g. the flow rate, leakage limits and open-close timing. In addition, two Poppet configurations were manufactured, regular and a jagged, and investigated using advanced optical imaging techniques. The Influence of the Poppet configuration on the gaseous jet behavior and mixing with the in-cylinder air was investigated.

In this work, the direct-gaseous-injector design process is reported, as well as the operation optimization process and the injectors experimental comparison results.

Note: the seminar will be given in English

Seminars Coordinator: Assoc. Prof. Matthew Suss.