REASE

THESIS PROPOSALS – update 25/01/2019

INTERNAL COMBUSTION ENGINES

THESIS PROPOSAL #1

TITLE: Development of a numerical approach for the evaluation of the flow coefficient of 2S Engines' ports

BRIEF DESCRIPTION: The research group makes use of the commercial solver ANSYS FLUENT for a long time in 2S engines' application. In the technical literature, few examples of methodologies for evaluating the ports' flow coefficient are present, due to the complex engine geometry. The thesis work will try to define the most appropriate strategy for defining the flow coefficient to be used in 1D numerical models of the engine. As a further step, different transfer duct geometries could be explored to optimize the fluid-dynamic behavior of the engine.

INSTRUMENTS: CFD 3D (ANSYS FLUENT) and 1D (Ricardo WAVE)

NOTES: innovative, practical use for industry (partnership with Betamotor), a scientific publication can be included

THESIS PROPOSAL #2

TITLE: Direct injection strategies for 2S engines - Enhancement of the injection performance

BRIEF DESCRIPTION: The research group has already developed different DI systems for 2S engines. Both numerical and experimental analyses has been carried out on Low Pressure Direct Injection (LPDI) and High Low Pressure Direct Injection (HPDI) solutions. The thesis work will further develop the potential of the injection system, exploring different geometrical configurations of the engine (ports shape, ducts orientation, introduction of swirl, etc.) and/or of the injector (nozzle characteristics, spray penetration and diffusion, droplet atomization).

INSTRUMENTS: CFD 3D (ANSYS FLUENT)

NOTES: innovative, practical use for industry (partnership with Piaggio and/or Betamotor), a scientific publication can be included

THESIS PROPOSAL #3

TITLE: Direct injection strategies for 2S engines – Intermittent cycle injection

BRIEF DESCRIPTION: Development of a 2S engine control method for the reduction of fuel consumption and emission by skipping fuel injection for a number of cycles dependent upon a decrease in the engine load. Both numerical and experimental analyses has been already carried out for an LPDI case study. The thesis work will aim at performing a thorough CFD study for the evaluation of the performance enhancement with respect to standard 2S operation at low load and low speed.

INSTRUMENTS: CFD 3D (ANSYS FLUENT) and 1D (Ricardo WAVE)

NOTES: very innovative, practical use for industry (partnership with Betamotor), at least one scientific publication will be included

THESIS PROPOSAL #4

TITLE: Optimization of a 2S engine for stationary applications

BRIEF DESCRIPTION: In recent works, the research group has demonstrated the interesting potential of 2S engines in achieving high efficiency and low pollutant emissions for specific operating conditions. Maximization of the performance at a fixed speed and load could lead to very high efficiency, if proper technical solutions are adopted on the engine. The thesis work will carry out a multi-parameter optimization of the engine by means of 1D numerical tools, exploring different techniques to be used on the engine, such as DI, prechamber, intermittent cycle injection, by-pass valves, etc. Engine geometry (ports diagram, exhaust system) will be re-designed for the specific condition.

INSTRUMENTS: CFD 1D (Ricardo WAVE)

NOTES: very innovative, more than one scientific publication could be included

THESIS PROPOSAL #5

TITLE: Validation of numerical models for combustion prediction in ICEs

BRIEF DESCRIPTION: The improvement of the combustion efficiency is currently the main topic of the worldwide research in the field of ICEs. The use of 3D numerical models is mandatory in the development of new solutions such as LTC combustion. The thesis work will be focused on the calibration and validation of a 3D CFD simulation model for the analysis of the injection and combustion processes of a 4S engine based on the availability of a high-quality set of experimental data. The experimental measurements (provided by the CNR – Istituto Motori of Napoli) will include the visualization of both the spray vaporization process and the flame front propagation.

INSTRUMENTS: CFD 3D (ANSYS FLUENT and/or CONVERGE CFD)

NOTES: very innovative, partnership with CNR, at least one scientific publication will be included

THESIS PROPOSAL #6 (BACHELOR DEGREE ONLY)

TITLE: Development of an analytical approach for correcting the pressure measurements inside the combustion chamber of ICEs

BRIEF DESCRIPTION: In-cylinder dynamic sensors for the acquisition of instantaneous pressure inside the combustion chamber are necessary for evaluating the working cycle of an engine at the test bench. Such sensors provide a "relative" value of pressure, therefore they must be calibrated in order to obtain the "absolute" pressure level. During the calibration, a bias error could be introduced, thus leading to inaccurate measurements. The thesis work will be focused on the development of an analytical approach for correcting the pressure measurements based on the comparison between experimental and numerical data.

INSTRUMENTS: Microsoft Excel or Matlab, if need be CFD 3D (ANSYS FLUENT)

NOTES: innovative, one scientific publication could be included

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