Methodology for Combustion Engine Multi-Objective Optimization using Meta-Models and Genetic Algorithms

**G.Buccilli1, R. Wohlgethan1**

1EnginSoft GmbH, Frankfurt, Germany

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This work presents a methodology for multi-objective optimization of a Diesel-engine. The objectives are maximizing the brake power while minimizing NOx emissions, using GT-POWER for the combustion analysis and modeFRONTIER for Design of Experiment (DOE) and multi-objective optimization. In the optimization process, modeFRONTIER runs in batch GT-POWER to create the new designs and to do the engine calculations. As a first step a DOE is created to distributed an initial design population uniformly in the complete parameter ranges. Based on this initial population, Response Surface Method is used to create a continuous mathematical model (meta-model) of the systems behavior. This meta-model is then used to perform the multi-objective optimization using genetic algorithms. Further on, optimal engine designs are found by the means of the meta-model that are further validated using GT-Power. Finally a robustness evaluation is performed to find the most robust designs.

Software used:

GT-Power (Developed by Gamma Technologies)

modeFRONTIER (Developed by ESTECO)