

## **MCE5 VCRi Engine: Topological and Free Shape Optimization of the VCR Control Rack**

### **AUTHOR**

Dr. Matthieu DUCHEMIN, MCE-5 DEVELOPMENT S.A.

### **KEYWORDS**

Topology Optimization, Variable Compression Ratio, VCRi, Durability

### **ABSTRACT**

Founded in 2000, MCE-5 DEVELOPMENT is developing the MCE-5 variable compression ratio engine (VCRi) which reduces fuel consumption and CO<sub>2</sub> emissions by up to 45 percent or more.

The MCE-5 VCRi technology integrates innovative components that transmit power from the piston to the crankshaft. While the architecture of the MCE-5 VCRi engine enables it to withstand very high loads, the single components have to endure heavy loads. On the other hand, the global weight of the engine is a determining parameter for the performance of this new technology. To combine those two objectives, the material distribution of each component must be optimized.

The development process for a new control rack for the MCE-5 VCRi engine is intensively based on simulation. The MCE-5 workflow includes topological and free shape optimization at the very beginning of the project. Weight target and respect of the industrial process are taken into account at this step. After a few design loops, the new rack is completely computed in order to evaluate its fatigue lifetime before test on a test bench, then in a single cylinder engine and a multi-cylinder engine. The results of all these tests are correlated with the simulation to keep a direct link between the virtual world and the complex reality of an engine.

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