

## **MCE-5 VCRi demonstration engine NVH preliminary analysis**

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### **KEYWORDS**

NVH, Speed irregularity, Engine balancing

### **ABSTRACT**

Introducing the VCRi kinematic for IC engines is an efficient solution to decrease their fuel consumption. Such a modification has a significant impact on the design of the moving parts and the short block. The new parts and the modified ones required for the new kinematic imply a modification of some key parameters for the NVH behaviour of the engine: modified stiffness, modified moving mass, new load paths, new noise sources. A demo engine, fitted in an existing car with standard engine mounts, showed no significant issue: lack of engine mount tuning inducing some vibration at idle, radiated noises through the firewall (additional holes for the wiring of the data acquisition systems).

First in this presentation, the VCRi kinematic is briefly described, with a focus on the main differences related to the NVH behaviour and the parameters previously enumerated. Then, new radiated noises introduced by the kinematic are experimentally identified on a demo engine and the retained solutions to reduce them to an acceptable level is defined. Regarding the loads introduced into the body in white, the simulation tools used are briefly described. The next topic deals with the speed irregularity at the flywheel, showing that its level is not impacted by the VCRi kinematic at a given load level, allowing the use of traditional solutions to deal with it. The last part is dedicated to the impact of the modified mass on the balancing characteristics of the engine. A comparison between the VCRi demo engine and a traditional engine shows that balancing shafts are not required for a L4 engine. Then, the L3 configuration is briefly discussed.

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