SOME ASPECTS OF VIBRATION SOURCE SIMULATION IN CASE OF AN I.C. ENGINE

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In order to develop sound FEM and BEM models for I.C. engine noise and vibration analysis a prior knowledge of sources is necessary. These sources must be integrated in the FEM or BEM models to find out the engine structure response. There are two main ways to study these sources characteristics. The first one is to measure the vibrations of engine surface in different points and to acquire and process the obtained data. The other way is to generate a model of the engine kinematics and dynamics and to obtain the source behavior, running a series of simulation on this model.

This paper presents a detailed multi-body numerical nonlinear dynamic model of a four cylinder internal combustion engine. The model comprises all rigid body inertial members, joints, couplers, and connections between the various engine components, as well as means of vibration elasticity and damping. The model is based on a MATLAB SIMULINK (SIMSCAPE) engine model existent in MATLAB 7.6 model library which allows only the study of engine crankshaft RPM. The author had further developed the model for vibration analysis, integrating mass, elastic and damping components. The model enables virtual testing of the engine operation. The results obtained provide time histories of the dynamic response of the engine block and spectral analysis diagrams. The torsion vibrations of the crankshaft can be also analyzed.

The numerical solutions of nonlinear inertial rigid body dynamics, the combustion process, and nonlinear vibrations of the crankshaft and engine block enables about a new approach in the numerical analysis of complex nonlinear multi-body dynamic problems.

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