

## Vibration and acoustic pre-assessment study for free piston engine structure

### ABSTRACT

This paper presents modelling and simulation study of vibration and acoustic for a new free piston engine. The free piston engine is a new engine concept where its piston motion is not restricted by the crankshaft component. The free movement of the piston influenced by forces developed from the fuel combustion process and air compression in the engine. The piston movement has become an issue or a problem which consequently developed vibration to the engine structure because of the unbalance forces. Vibration analysis has been developed using finite element software which is MSC.PATRAN in order to determine the natural frequency and frequency response of the engine structure. Theoretical development of the engine balance motion and frequency response has also been conducted. From the simulation and finite element analysis, the force response pattern of the engine vibration can be determine and compare with its natural frequency. The vibration analysis will then be used as the input data for acoustic analysis of the engine. The acoustic analysis used boundary element method coupled with finite element method to determine the noise level produce by the engine structure. This integration determined the noise - frequency data that affected the engine structure towards the occurrence of engine noise especially when engine is in operation mode.

**Keyword:** Vibration; Acoustic; Free piston engine; Finite element analysis; Boundary element method