Master's Thesis

Modelling and Simulation of defects on Rail wheels for generating and analysing vibration signals

The ever-increasing demand for faster, safer and comfortable transportation makes the constant increase in the efficiency of Railway transportation inevitable to sustain in the market. Further increased speed and the heavy loads result in complex impacts and shock loads etc., resulting in the wear of the train components which leads to higher maintenance costs.

These above factors create a great challenge to find ingenious ways to reduce the maintenance costs and at the same time provide uninterrupted and efficient services. Wheel flat defects are the most common types of defects on trains which needs immediate focus.

In this research, a novel method of in-service condition monitoring using acceleration sensors is developed to detect wheel flats. Simpack is used to perform the simulation of various wheel flat conditions and the signals from the sensors was analysed for online monitoring, diagnosing, and predicting of the wheel flats.

Further, the effect flexibility of wheelsets on the signals was also studied. The comparison study on MBS and FEMBS model showed considerable variations in the acceleration signals with flexible wheelsets providing better results.
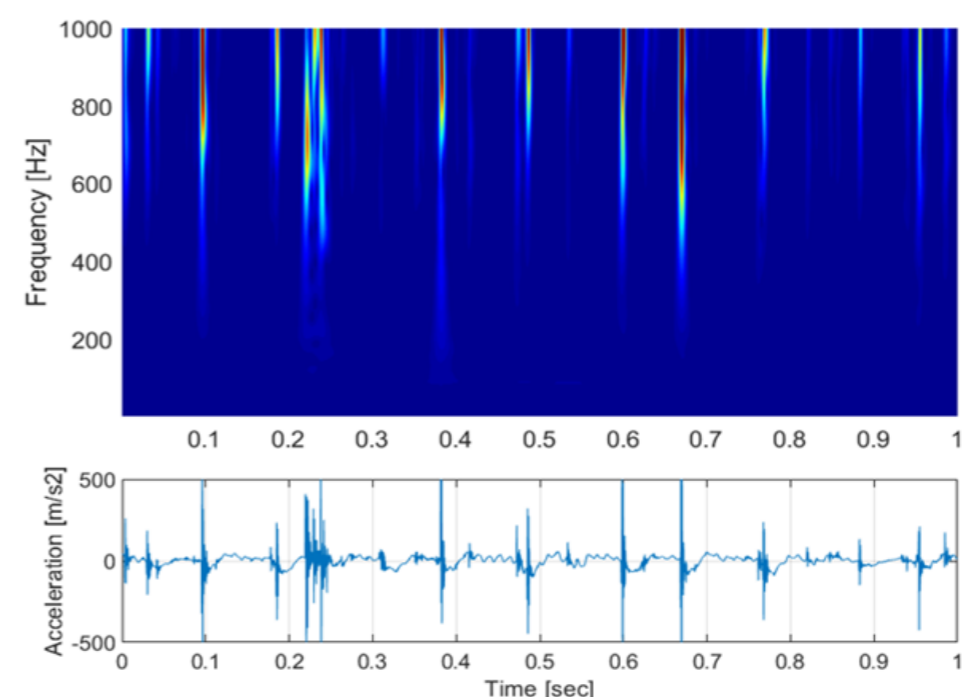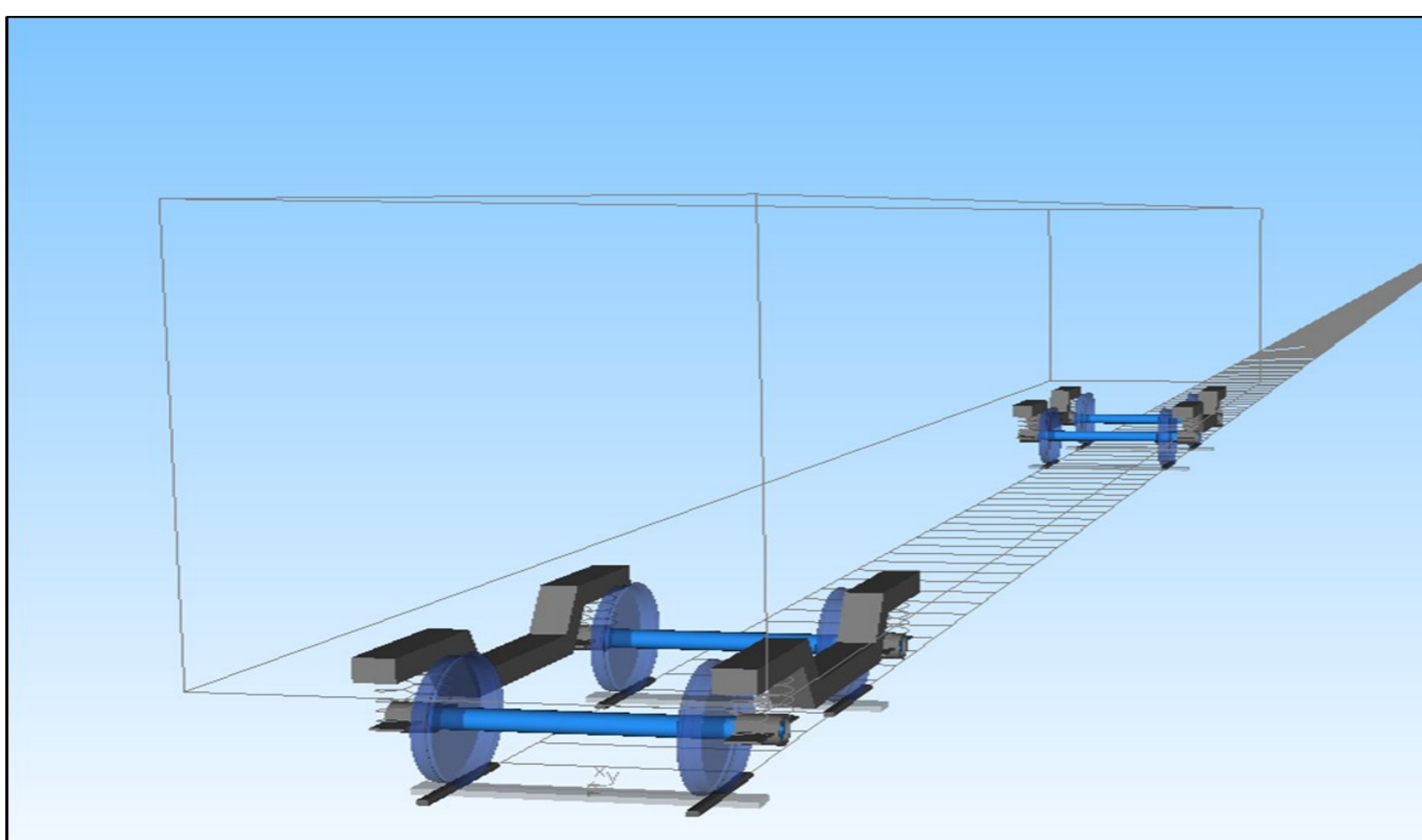

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- MBS and FEMBS models of a Train is created for simulation

- Sensors were fixed on the top of the axle box to measure acceleration caused by the impact load

- Wheel flats induce large impact forces and the subsequently causing axle box accelerations

- The ABA of FEMBS showed considerable differences which are attributed to flexible body deformation.
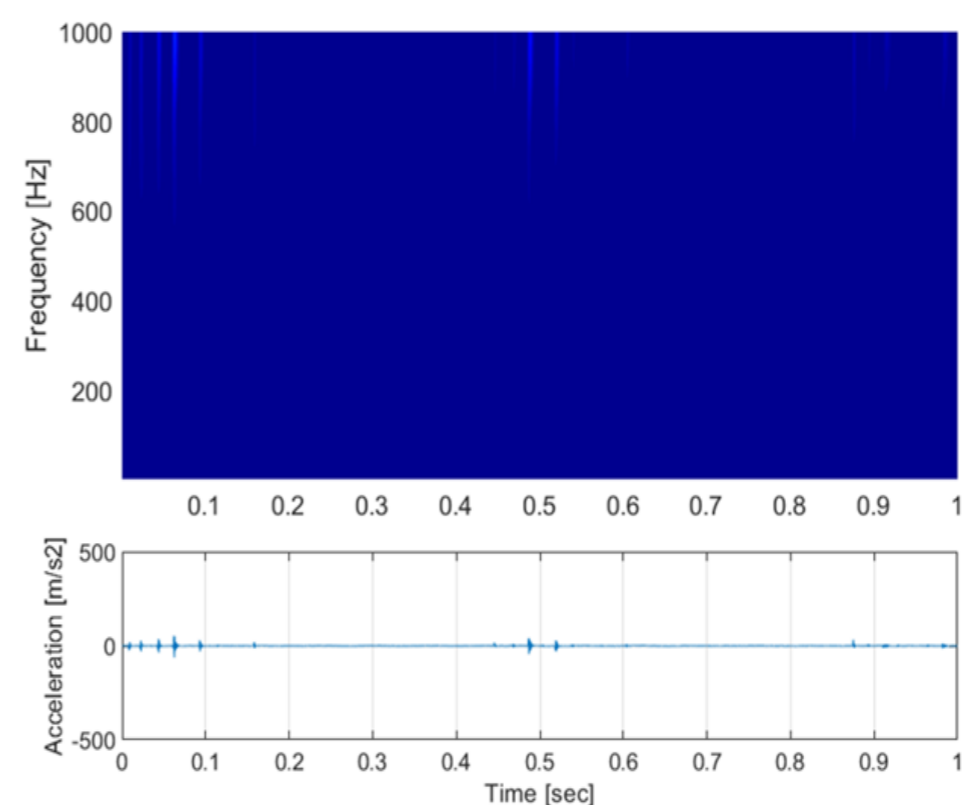
ABA of Wheels without defect

Simpack train model

ABA of Wheels with Flat

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