Railway rolling noise mitigation through optimal track design

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ABSTRACT

The main goal of the present work lies in the identification of the railway track properties that influence acoustic radiation, as well as in the analysis of these properties for the reduction of sound levels. This is achieved through a dynamic model of the railway wheel and track that allows the study of rolling noise, produced as a result of wheel/rail interaction.

The vibroacoustic calculation methodology consists of characterising the railway wheel and track, using finite element techniques and periodic structure theory [1,2], respectively. Subsequently, the response of the railway components, which is caused by the roughness present in the surface of the wheel and rail, is determined. Finally, after having the vibrational response of the railway elements, the sound power radiated by them is calculated using the acoustic model developed by D. J. Thompson et al. and implemented in TWINS software [3].

The influence of the track properties on the sound radiation is analysed through statistical techniques applied to the acoustic power results of different track configurations. To do this, the geometry of the rail profile is parameterised and simulations are carried out by modifying these parameters and the viscoelastic properties of the track components.

From the results obtained, a number of guidelines are presented for the noise mitigation of the involved railway subcomponents. Between the worst and the best track design, there are differences of approximately 7.5 dB(A) in the radiation (considering the wheel, rail and sleeper noise).

REFERENCES

