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INVESTIGATION INTO THE INDIRECT DETERMINATION OF WHEEL-RAIL SURFACE ROUGHNESS

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ABSTRACT
The increasing demand on environmentally sound vehicles is a world wide tendency and in particular the regulations on noise and vibration emission are getting strict. In case of railway vehicles, the rolling contact noise is the predominant source of noise in the range of common operation speed and only at high speed becomes the aerodynamic noise also significant. The rolling noise is primarily caused by the roughness of wheel and rail surfaces, i.e. by the out-of-roundness of wheel and waviness of rail, as these imperfections generate a vertical excitation on the vehicle as well as on track. The systematic determination of wheel-rail roughness is of essential importance for the control of real noise emission and it provides a basis for diverse computational acoustic simulations. Noise emission standards formulate limiting values for rail roughness over a wavelength range of approx. 2 mm to 0.6 m, and the direct measurement of roughness is proposed. This direct measurement means the scanning of wheel-rail surfaces separately with a mechanical or optical device. The so called pass-by measurement is a complementary indirect method, as it is based on the measurement of rail base acceleration; from which the wheel-rail roughness in the vicinity of test point is derived. The main drawback of both procedures is that the scope of the survey is restricted to a couple of meters long rail section. The intention of this study is the development of another indirect method that allows the determination of wheel-rail roughness over longer railway lines. Since the axle-box acceleration signals can be easily measured, the application of this information is proposed for the estimation. The evaluation of the methods is based on experimental tests and vehicle-track dynamic simulations.

Keywords: wheel-rail roughness, rolling noise, pass-by measurement, vehicle-track simulation