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Editorial

Running Dynamics of Rail Vehicles

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1. Introduction

The importance of simulation calculations in developing railway vehicles and their subsystems is consistently growing compared to physical experiments and track tests. Computer simulations of vehicle running dynamics are gaining an increasingly important role in the railway vehicle acceptance process, the development of innovative running gears, the development of active controlled suspension systems, the prediction of wear of wheels and rails, the prediction of noise emissions, the optimization of energy consumption and many other current topics. The investigation of railway vehicles running dynamics plays an important role in many research and development areas of railway engineering, such as:

- Innovative running gear designs;
- Utilisation of active controlled systems in running gears;
- Wheel–rail force interaction;
- Wear of wheels and rails;
- Testing and simulation of the acceptance of running characteristics of railway vehicles;
- Verification and validation of simulation models;
- Vehicle dynamics modelling and simulation;
- Co-simulation and model coupling;
- Reduction in the noise generated by railway transport;
- Reduction in the energy consumption of railway transport;
- Alternative energy sources;
- Rail transport safety.

The purpose of this Special Issue is to publish the latest developments and results of theoretical and experimental research and to show the current problems their solutions in the simulation and testing of the running dynamics of railway vehicles.

2. A Short Review of the Contributions in This Issue

The call for papers to this Special Issue generated 12 submissions of very interesting, high-quality papers from Poland, Ukraine, Czech Republic, Slovakia, China and Lithuania. Five papers were published.

Kisilowski and Kowalik focused on the wear of turnout components of high-speed tracks. In their work [1], the simulation results of a high-speed train passing a turnout under variable conditions are presented, and dynamic forces acting in wheel–rail contacts and the wear coefficient are evaluated. The variable track stiffness along the switch is taken into the account in their model. The wear process of turnout elements and wheels is presented.

Zhang et al. focused on high-speed train traction drives. The paper [2] describes a mathematical model considering the interaction of the gear pair, transmission system, circuit of the traction motor, and the direct torque control strategy. The results of the co-simulation of mechanical and electrical parts of the traction system under traction, constant speed, and braking conditions are presented and discussed.

Idczak et al. investigate the dynamic impact of rail transport on the surrounding infrastructure with a particular focus on the phenomenon of the threshold effect within the transition zones of an engineering facility [3]. The problem of locally variable stiffness of the railway infrastructure, which could lead to accelerated infrastructure degradation, is identified. Theoretical results are compared to the field measurements conducted on a real track dynamically loaded with various types of passing vehicles.

The paper of Goolak et al. [4] deals with the analysis of the operating conditions of traction drives of the electric locomotives with asynchronous traction motors. The method of current controller synthesis based on the Wiener–Hopf equation was proposed to enable the efficient performance of the traction drive control system under the stochastic fluctuation of the catenary system voltage. The simulation results of the performance of the proposed current controller are presented and compared to the performance of the current controller used in the existing vector control systems of the traction drives of electric locomotives.

Polak and Korzeb focus on the acoustic impact of a train travelling at the speed of 200 km/h in straight sections and track curves [5]. The field test results were applied to the construction and verification of the model of sound propagation. The results of the test field measurements are presented, the main sources of noise coming from the studied train unit are identified and the dominant amplitude–frequency are determined.

The energy that an electrified railway line takes from the electrical grid fluctuates significantly, and the peaks often reach the power limit of a grid. In [6], Olexandr Shavolkin et al. propose to solve this issue using a photovoltaic system and battery storage working in parallel to the electrical grid supply. The mathematical model of such electrical system has been developed; based on the simulations of the parameters of the photovoltaic system, they have been justified; and the system's capabilities in the daily mode for different seasons of the year have been assessed.

3. Conclusions

The investigation of rail vehicle running dynamics plays an important role in the more than 200 year development of railway vehicles and infrastructure. Currently, there are a number of new requirements for rail transport associated with the reduced environmental impact, energy consumption and wear, whilst increasing train speed and passenger comfort. Therefore, the running dynamics of rail vehicles is still a research topic that requires improved simulation tools and experimental procedures. We would like to thank the authors of the papers included in the Special Issue "Running Dynamics of Rail Vehicles" in the journal *Energies* for their contribution to this topic.

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