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Modeling of Dynamic Aspects of Operation Railway Vehicle Traction Drive System Including the Electromechanical Coupling

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Abstract

In the paper, a dynamic electromechanical interaction between the wheelset of railway vehicle and its driving electric motors is investigated. This is the high-speed train driven by the electric motors through elastic hollow shaft with linear characteristics. In particular, there is considered an influence of negative electromagnetic damping generated by the motor on a possibility of excitation of resonant torsional vibrations. Conclusions drawn from the computational results can be very useful during
a design phase of these devices as well as helpful for their users during a regular maintenance.

1. Introduction

Torsional vibrations occur in every drive train. If a simple drive train consists of an electrical motor, shaft flexible and a load, the system has two basic torsional vibration modes, the rigid-body mode and the first elastic mode. The knowledge about the torsional vibrations in drive transmission systems of railway vehicles is of a great importance in the fields dynamics of mechanical systems [1,2,3]. Parts elements of driving system are not fully rigid, it is common to have fluctuation of torques in different sizes and phases leading to shaft and wheelset torsional vibration [6]. For a reliability and security of drive system of railway vehicles drive by electric motors, the electromagnetic output traction force and torques should drive stably, otherwise the shaft train vibration caused by motor torque ripple will affect the fatigue life of the drive components and the operation security of the driven railway vehicles [4,5,6]. Since railway drive can be divided into electrical and mechanical part of systems, the influence of the electric motor should also be taken into account in the analyzes.

2. Summary

Presented in the paper results have demonstrated that the electromagnetic transient processes generated in the electric motor should be taken into account for the use of the assessing the stability of the system. The knowledge about stability of drive transmission systems of railway vehicles is of a great importance in the field of dynamics and material fatigue of the drive systems component.

In the paper, a dynamic interaction between the torsionally vibrating rotor railway drive system driving electric motor was investigated. In analized case we focused attention on the stiffness and damping coefficients associated with the electromagnetic field of DC motor. The less mechanical damping in the driven system, the greater possibility of severe torsional resonances, particularly when in such a drive train an semi elastic connection as hollow shaft with a linear characteristic is used. The obtained results can be very useful during a design phase of these devices as well as helpful for their users during a regular maintenance

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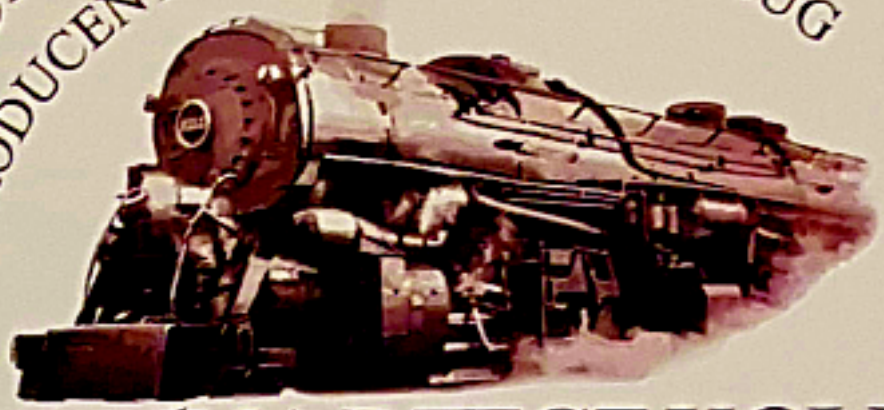

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