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ADVANCED RAIL TECHNOLOGIES



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ADVANCED RAIL TECHNOLOGIES

STABILITY ANALYSIS OF THE RAILWAY VEHICLE DRIVE WITH ELECTROMECHANICAL COUPLING EFFECTS

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Introduction

Aiming at the torsional vibration in the electromechanical driveline system for railway trains [1], this article introduces a stability analysis of the drive system with electromechanically coupling. 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 device and the operation security of the driven object. For this reason an investigation of the dynamic response and stability of a electromechanical drive train system was done. For this purpose a dynamic model integrated with an electric motor to simulate the vibration in the component parts of the drive system were created. Such an approach for modelling of the considered electrical drive systems coupled with elements of a driven vehicle is particularly important when the purpose of such modelling is to obtain an information about the transient phenomena of system operation.

Considered the research problem

In the study the electric locomotives with the fully sprung wheelset drive is considered. In this drive system the DC traction motor is integrated with drive unit. The output driving torque is transmitted via coupling (flexible multi-rod) to the hollow shaft, which surrounds the wheelset axle. On the opposite end of the hollow shaft the torque is transmitted by means of a coupling (flexible multi-rod or flexible claw coupling) to the disc-wheel. Using the energy balance of the natural modes of oscillations for the model of a railway traction drive are obtained expressions for determining the influence of electromagnetic parameters of an electric motor (stiffness and damping of electromagnetic field) on its stability in relation to torsion oscillations of the driveline.

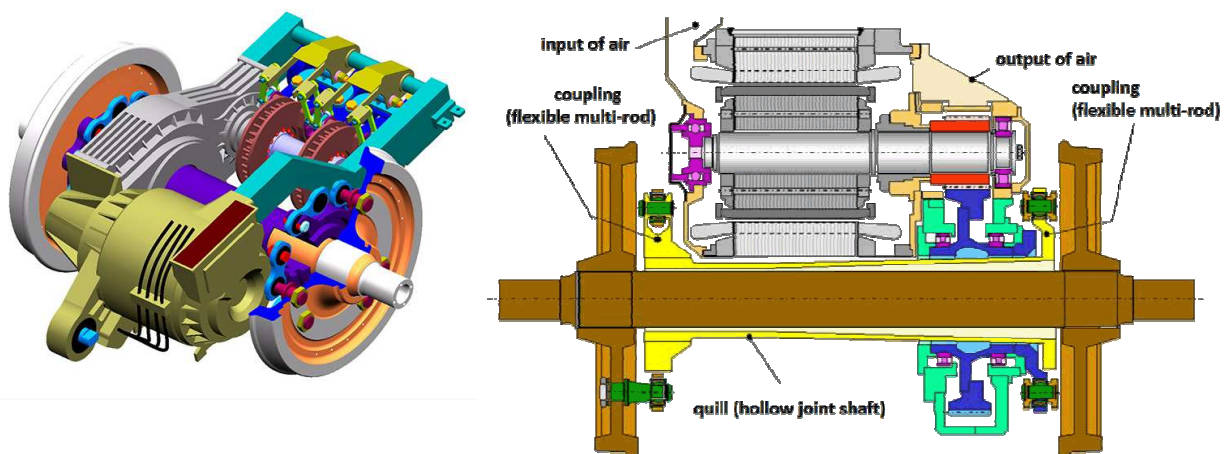


Fig. 1. Scheme of principle of fully sprung wheelset drive

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Summary

The obtained results have demonstrated that the electromagnetic interaction 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 machines and railway vehicles is of a great importance in the field of dynamics and material fatigue of the mechanical systems. Results obtained from the computer simulations demonstrated key influence mutual electromechanical couplings on the system and can be reference for the design of electromechanical drive systems in the railway electrical vehicles and not just there, example [2,3] and another [4] . Using the energy balance of the natural modes of oscillations for the model of a railway traction drive are obtained expressions for determining the influence of electro-magnetic parameters (stiffness and damping of electromagnetic field) on its stability in relation to friction self-oscillations.

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