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# Active control strategy on a catenary pantograph validated model

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**Abstract— Dynamic simulation methods have become essential in the design process and control of the catenary-pantograph system, overall since high-speed trains and interoperability criteria are getting very trendy. This paper presents an original hardware-in-the-loop (HIL) strategy aimed at integrating a multicriteria active control within the catenary-pantograph dynamic interaction. The relevance of HIL control systems applied in the frame of the pantograph is undoubtedly increasing due to the recent and more demanding requirements for high-speed railway systems. Since the loss of contact between the catenary and the pantograph leads to arcing and electrical wear, and too high contact forces cause mechanical wear of both the catenary wires and the strips of the pantograph, not only prescribed but also economic and performance criteria ratify such a relevance. Different configurations of the proportionalintegral-derivative (PID) controller are proposed and applied to two different plant systems. Since this paper is mainly focused on the control strategy, both plant systems are simulation models though the methodology is suitable for a laboratory bench. The strategy of control involves a multicriteria optimisation of the contact force and the consumption of the energy supplied by the control force, a genetic algorithm has been applied for this purpose. Thus, the PID controller is fitted according to these conflicting objectives and tested within a nonlinear lumped model and a nonlinear finite element model, being the last one validated against the European Standard EN 50318. Finally, certain tests have been accomplished in order to analyse the robustness of the control strategy. Particularly, the relevance or the plant simulation, the running speed and the instrumentation time delay are studied in this paper.**

**Index Terms— active control; catenary-pantograph; dynamic interaction; optimisation; multiobjective**

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