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Review of control strategies used in modern railway vehicles

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ABSTRACT

Control systems are being developed in the railway industry to maintain good steering, stability and comfort. Although, these systems are in operational, there are prospects of fully implementing mechatronic principles through an integrated control system. This paper is intended to provide various aspects of control system technology that are incorporated in modern railway vehicles and to give illustrative examples of where particular control objectives have been met. Its main contribution is to identify opportunities for further research in this field.

INTRODUCTION

The use of railway vehicles worldwide has increased and thus, more and more trains are being produced. This trend is unlikely to change anytime soon. Therefore, there is a need to develop trains that provide safe and comfortable transportation, and at the same time have minimal impact on the environment. The challenge is to develop vehicles that can satisfy these conflicting requirements. One of the steps in achieving this is the use of mechatronic subsystems that employ sensors, actuators and control systems. There are several control strategies which have been developed to automate various operations within the railway vehicle. Only the ones that are well established will be reviewed.

CONTROL STRATEGIES

1. Tilt control

- Improves the ride quality.
- Enables trains to curve at higher speeds.
- Maximizes the use of poor running conditions.

2. Active lateral suspension control

- Skyhook damping control
- Integrates the use of mechatronic systems within the railway industry

3. Active primary suspension control

- Active stability and steering control of wheelset
- Skyhook damping control
- Precedence control

4. Wheel slip control

- Adhesion force control based on field oriented vector control
- Maximizes the use of poor running conditions

CONCLUSIONS

- The level of integration of various aspects (traction, braking, suspension) is high, thereby more sophistication in designing a controller.
- The use of the contact patch between the wheel and rail for the designing of an integrated control scheme.
- The difficulty in accommodating all of the dynamical features.

REFERENCES