A Test Platform for Electromagnet-Rail Coupling Vibration of Medium-Speed Maglev

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Background

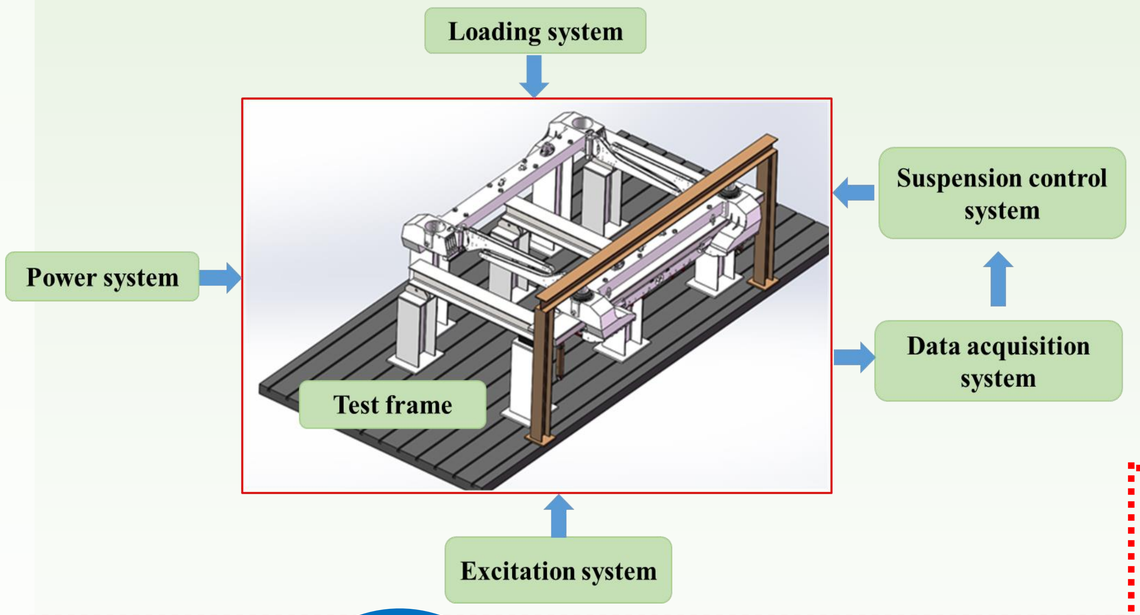
In recent years, maglev transportation is developing rapidly in China. Low- and high-speed maglev systems have been developed and commercialized. The medium-speed maglev system has a lot of advantages over low- and high-speed maglev systems. It will play a key role in future public transportation. In a maglev system, electromagnet-rail coupling vibration is a crucial factor contributing to the dynamic interaction of the maglev train-guideway system, which is directly related to the safety and stability of operation. Therefore, effective control of the electromagnet-rail coupling vibration is of great importance for developing the medium-speed maglev system. To this end, it is essential to investigate both the mechanism of the electromagnet-rail coupling vibration and the influencing factors by theoretical, numerical and experimental means. At present, both theoretical and numerical methods have been widely developed for different types of maglev systems. In the past two years, ***CNERC-Rail has also conducted a number of works on electromagnet-rail coupling vibration and suspension control algorithm for the medium-speed maglev system through theoretical and numerical means.*** To continue the research on the medium-speed maglev system, ***experimental tests are necessary to verify the delivered theoretical and numerical results and carry out in-depth studies in this field.*** Therefore, a test platform of electromagnet-rail coupling vibration for the medium-speed maglev system is needed.

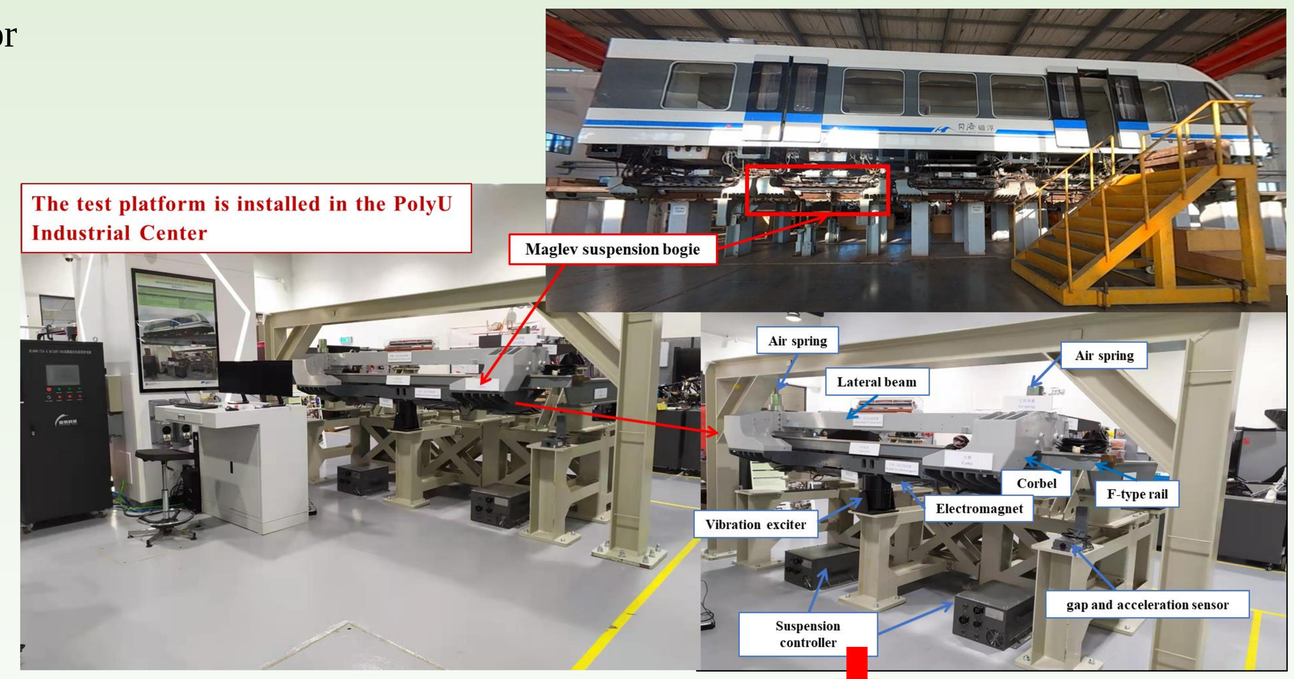
Objective

- Investigate the mechanisms of the electromagnet-rail coupling vibration in the medium-speed maglev systems;
- Study factors influencing the electromagnet-rail coupling vibration of the maglev system;
- Develop the suspension control algorithm to suppress the electromagnet-rail coupling vibration of the maglev system;
- Verify new technologies to improve the maglev system;
- Verify new damage detection and condition assessment methods for the maglev system;
- Establish digital twin models for the maglev system.

The six main components and their functions of the test platform

Test frame: full-scale suspension bogie and F-type rail;
Suspension control system: control the suspension gap between the suspension bogie and F-type rail;
Loading system: simulate the weight of the vehicle;
Excitation system: exert the excitation force on the F-type rail;
Power system: provide power for the electromagnets.
Data acquisition system: collect the vibration data from sensors.

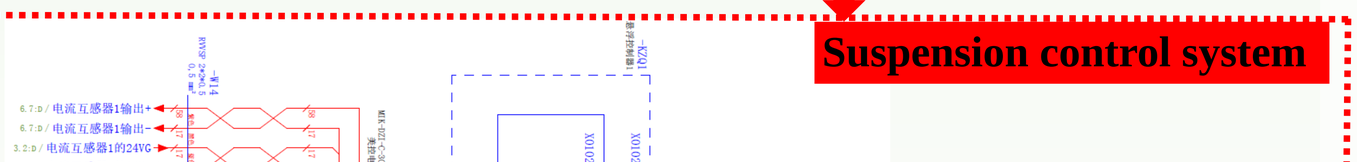




Suspension Bogie

Suspension Control Module

The Principle of Suspension Controller



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