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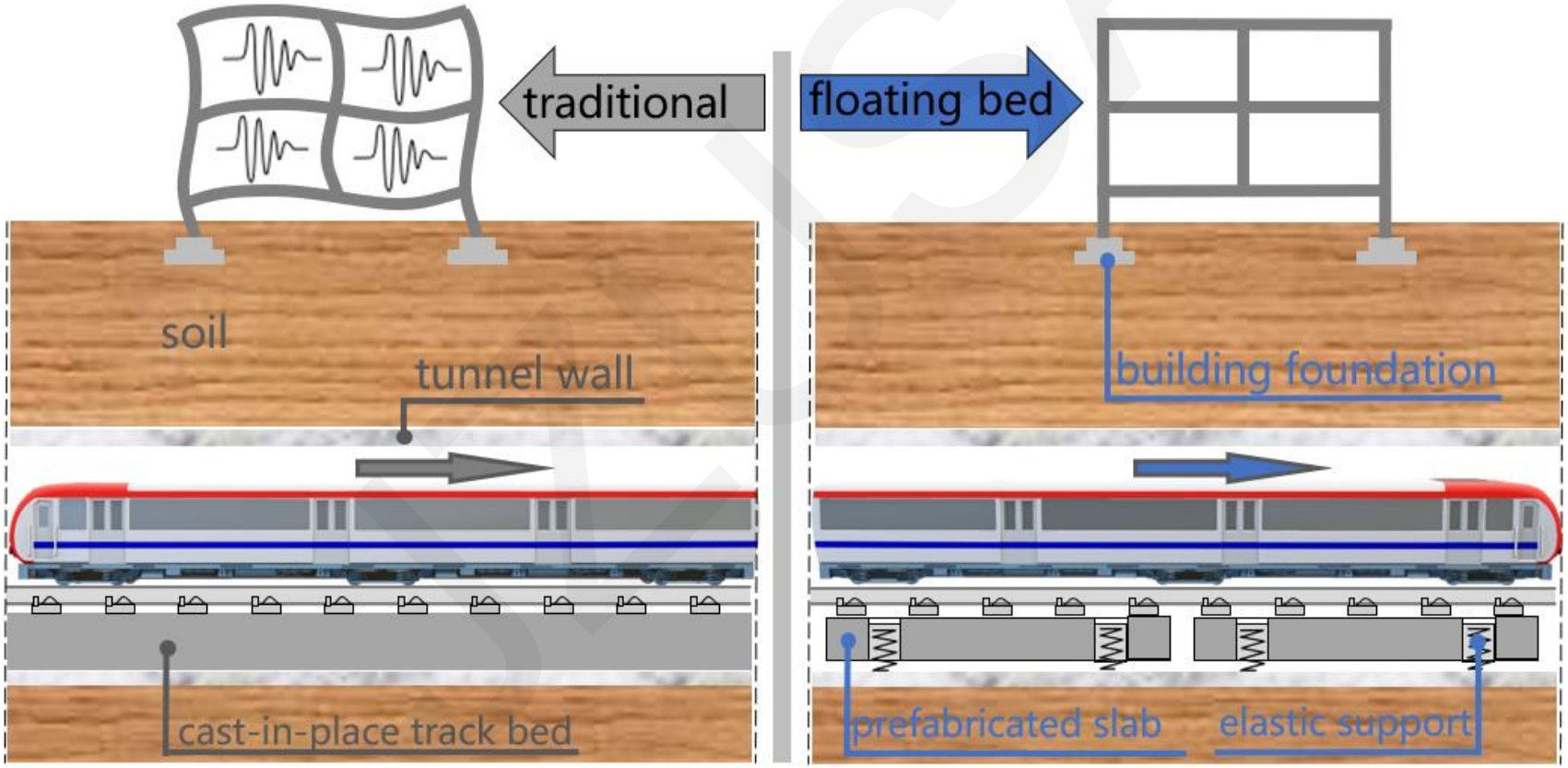
A method for support stiffness failure identification in a steel spring floating slab track of urban railway: a case study in China

Key words:
Floating slab track; Support stiffness; Detailed analytical model; Failure identification; Monitoring system

Background

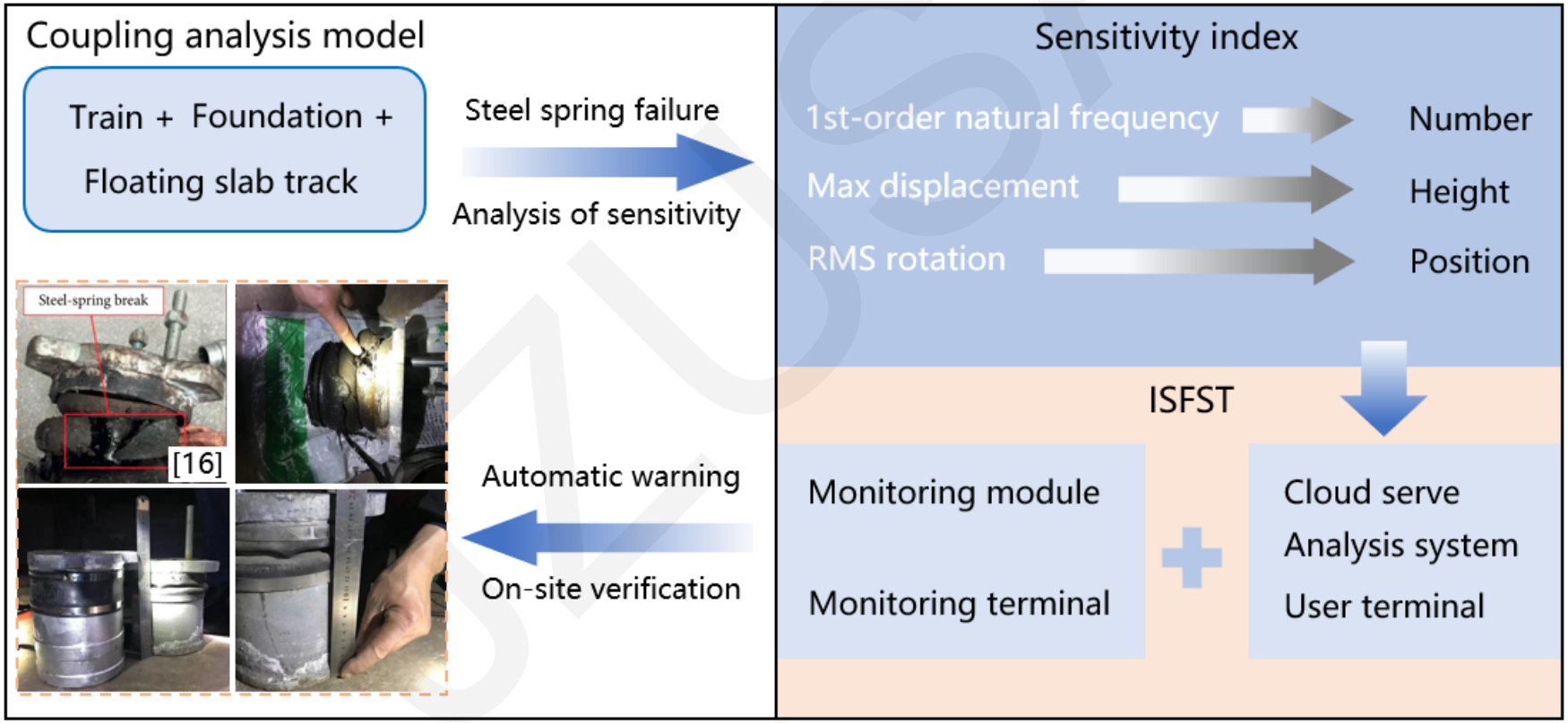
The extensive use of steel spring floating slab tracks has effectively reduced vibrations induced by urban rail transit systems. However, problems such as the fracture of steel spring often occur for complex dynamic reasons



Comparison between traditional track bed and floating slab track bed

Technology structure

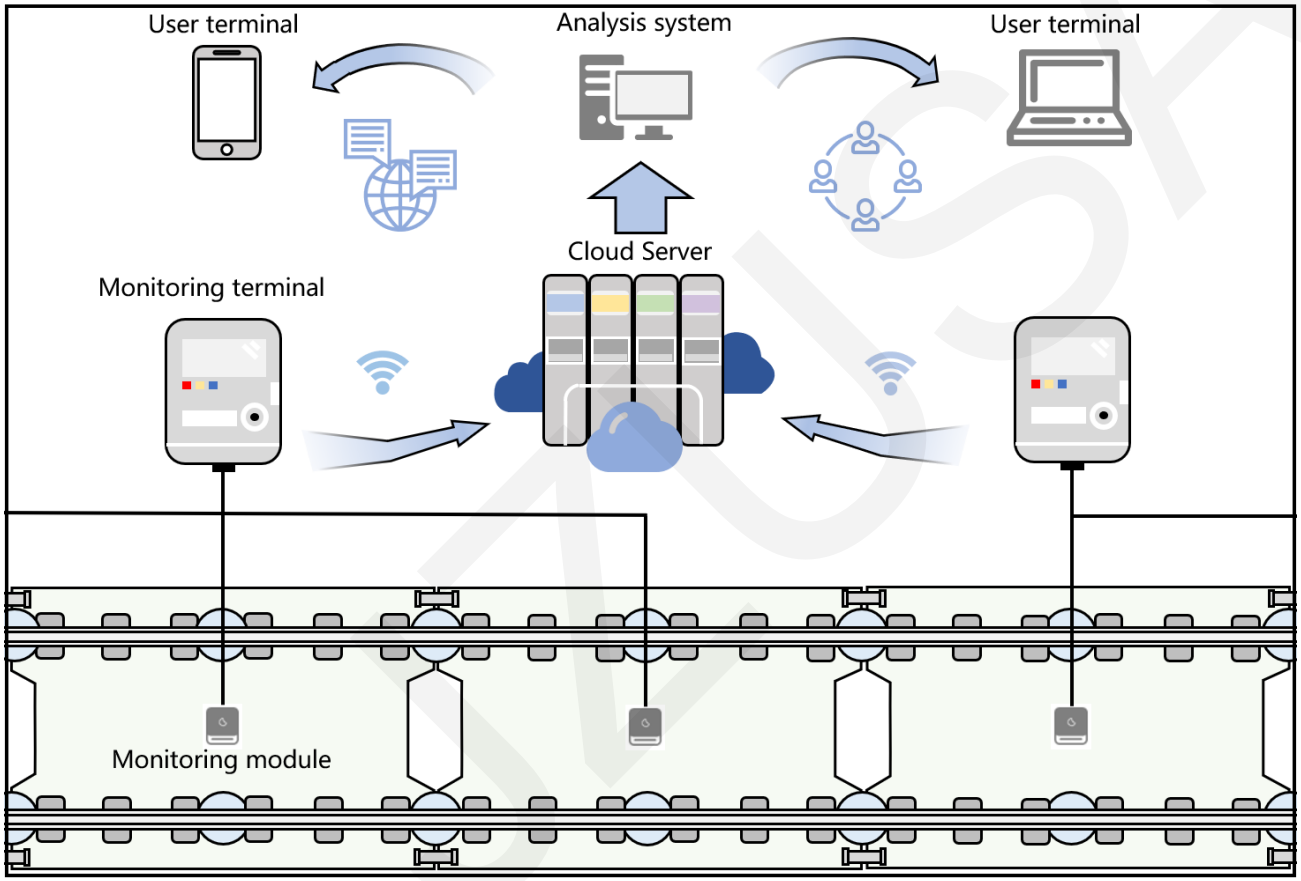
Methods for identifying the failure of steel springs are proposed. Based on the proposed method, an Intelligent monitoring system for the support stiffness of the Floating Slab Track (ISFST) system was developed



Proposed technology structure

Equipment Composition

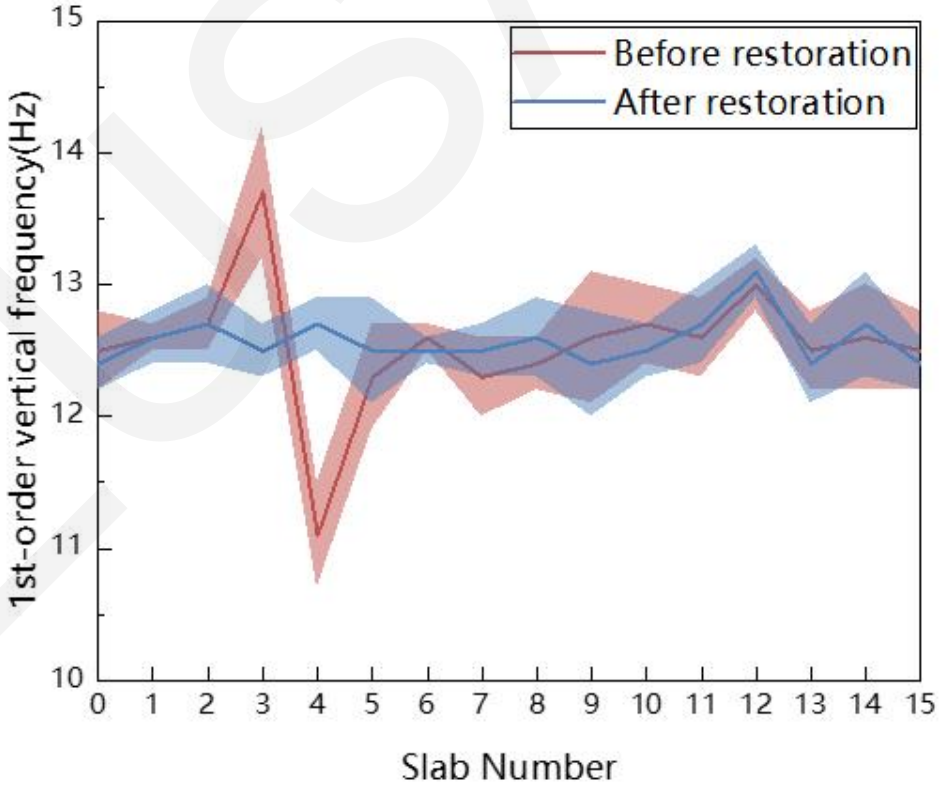
ISFST include monitoring module, monitoring terminal, cloud server, analysis system



Architecture of ISFST

Case 1: the suspension of steel spring

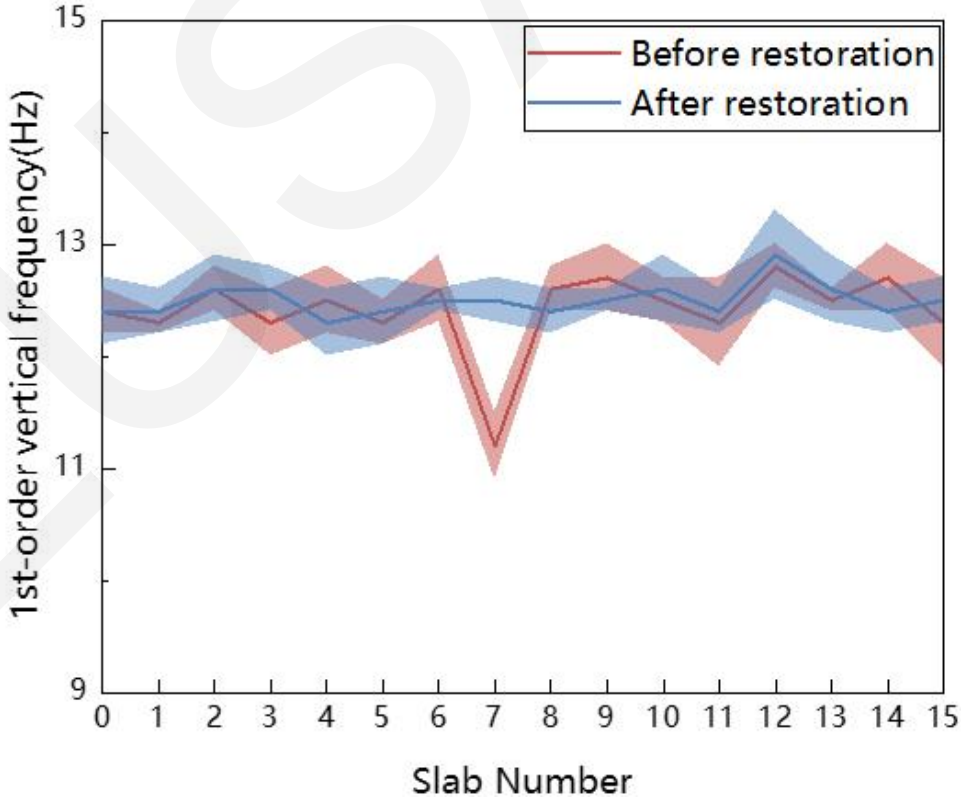
ISFST shows that the natural vibration frequency of the 4th floating slab is significantly lower than that of other floating slabs. This means that the spring is suspended, which is consistent with the on-site investigation.



On-site confirmation of steel spring hoisting

■ Case 2: the fracture of steel spring

The natural vibration frequency of the No. 7 floating slab is low, and the displacement is a little large. We infer that the steel spring has broken, and the on-site investigation and speculation are consistent.



On-site confirmation of steel spring fracture

■ Conclusion and Perspectives

Conclusion

- **The natural frequency, displacement, and rotation angle of the floating slab are important indicators for monitoring the failure of steel springs.**

- **Using the method proposed in the article, the system successfully monitored the suspension and fracture of the steel spring.**

Perspectives

- **The current method for monitoring the longest floating slab has certain difficulties, and a new algorithm needs to be proposed.**

- **In addition to the steel-spring failure mentioned in this study, there are also shear hinge fractures and fastener failures in floating slab track. The identification of these defects is worth further research.**