All articles in *Structures* are available free of charge to paying-grade members of the Institution as one of their membership benefits.

The journal is available online at: www.structuresjournal.org

Spotlight on *Structures*

Editor's Featured Article

Associate Editor, Yao Chen, has chosen a paper investigating high-speed maglev vehicle-bridge coupling vibration using hybrid simulations as the Featured Article for Volume 88 of *Structures*.

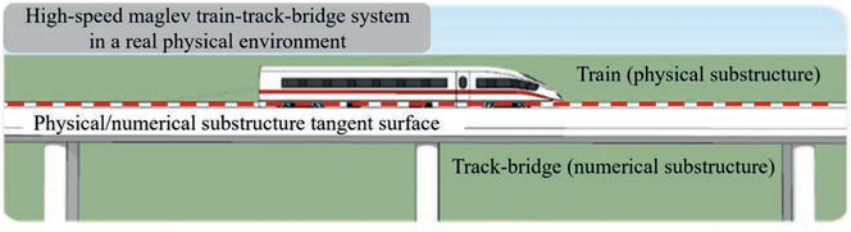
This article is available to read free of charge.

Research on offline real-time hybrid test of high-speed maglev vehicle-bridge coupling vibration based on PSO-optimized deep learning algorithms

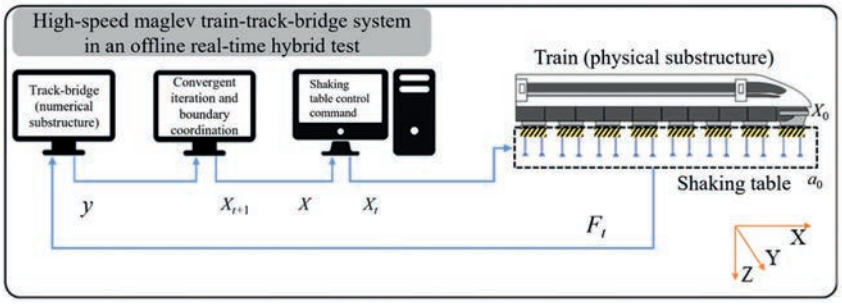
Wei Guo[a,b], Haoran Ma[a], Xuen He[a], Yang Wang[a], Yan Long[a], Weili Xie[a] and Zeao He[a]
[a] School of Civil Engineering, Central South University, Changsha, China
[b] National Engineering Laboratory for High Speed Railway Construction, Changsha, China

For the high-speed maglev vehicle-bridge coupling vibration, numerical simulations often fail to capture complex nonlinear dynamics, whereas field tests are costly and time-consuming. Hybrid simulation provides a balanced approach integrating large-scale physical testing with numerical analysis. Compared to real-time hybrid tests, the offline real-time hybrid test (ORTHT) eliminates the need for real-time computation, allowing for more complex models and ensuring test stability through open-loop loading. In this study, the ORTHT framework of the high-speed maglev train-track-bridge system was developed. Firstly, the conventional fixed-point iterative convergence control algorithm is adopted, yielding slow convergence speed and large simulation error in the initial few iterations. To accelerate convergence, a PSO-BP neural network was introduced to identify system dynamics and correct input signals. This approach is further enhanced by integrating PSO with a CNN-BiLSTM network, which improves spatiotemporal feature extraction and helps avoid local optima. Convergence analyses show that, in comparison with the 10–2 root mean square error of the fixed-point iterative algorithm, PSO-BP and PSO-CNN-BiLSTM can converge to 10–3 and 10–4, respectively. In addition, the identification effect of PSO-CNN-BiLSTM is superior to that of PSO-BP with acceptable computing time. This rapid convergence of the response predictions in earlier iterations satisfies the practical requirements for the ORTHT.

→| Read the full paper at **https://doi.org/10.1016/j.istruc.2026.111785**



(a) Numerical physical substructure division



(b) Signal flow of ORTHT

Register for alerts

If you'd like to receive regular updates about new content in *Structures*, register for email alerts at **www.sciencedirect.com**.