Elastic wave propagation characteristics of periodic track structure in urban rail transit

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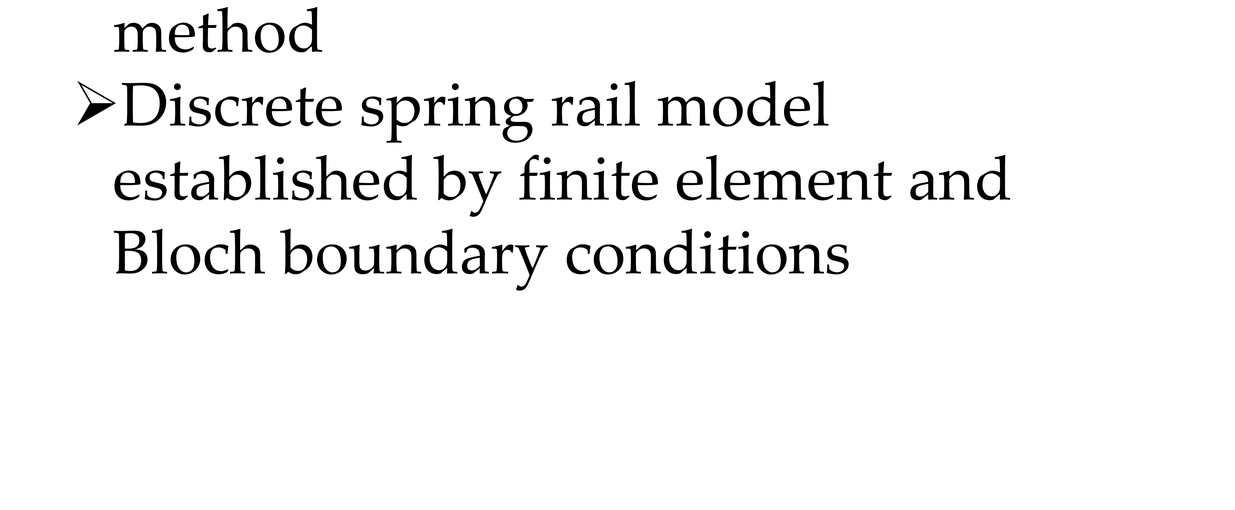
Introduction

Rails and auxiliary structures in rail transit can guide the direction of train travel. Due to the influence of rail boundaries, elastic waves will be guided to propagate in a specific direction. This elastic wave is called a guided wave. The waveguide characteristics of rails are the basis for studying non-destructive testing and vibration control of rails. Different fastener modeling forms will have a significant impact on the characteristics of rail waveguides.

Methods

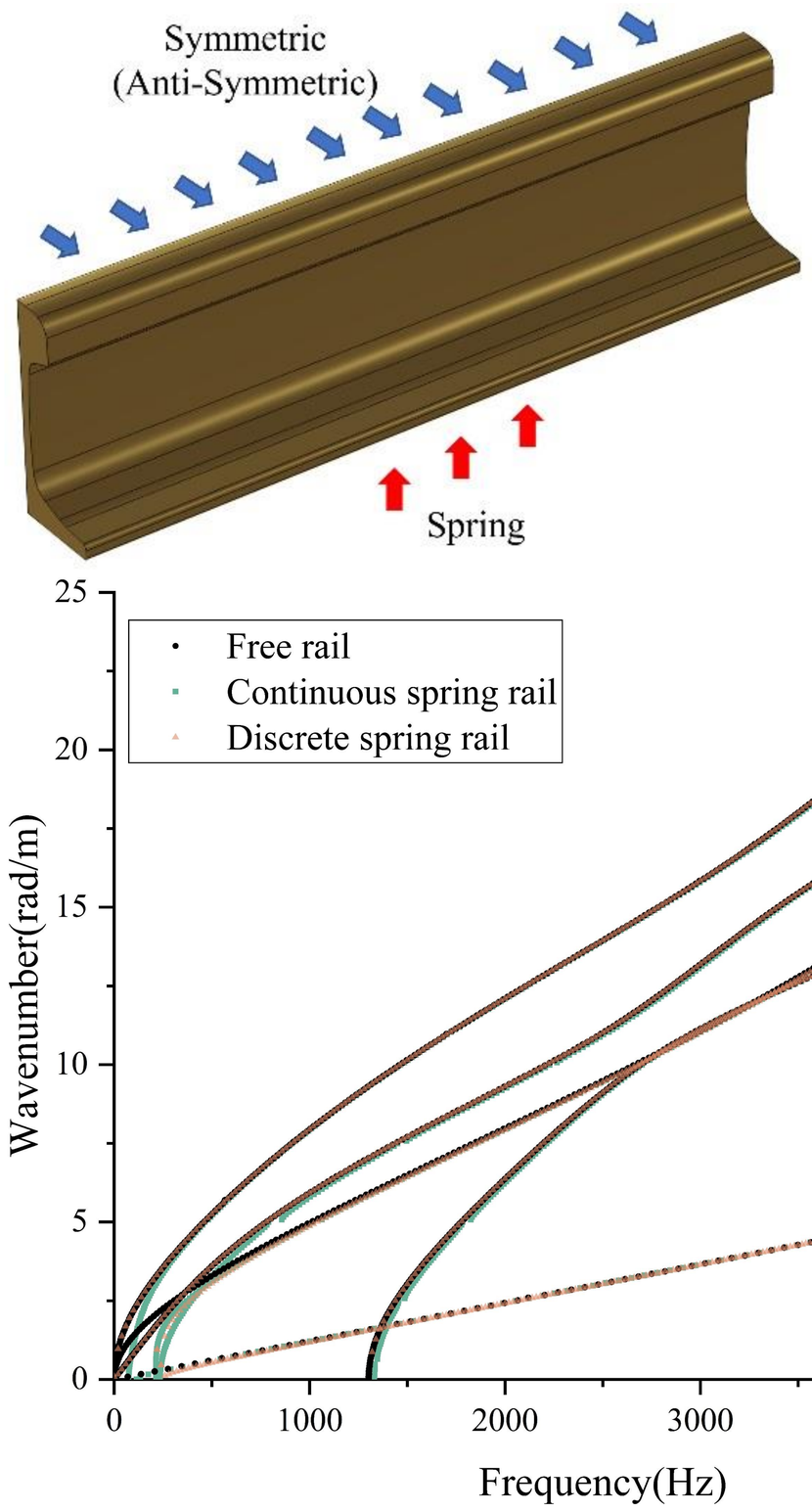
- Free rail and Continuous spring rail models established by semi-analytical finite element (SAFE) method
- Discrete spring rail model established by finite element and Bloch boundary conditions

Graphics / Images



Free rail model

Continuous spring rail models



Discrete spring rail model

Dispersion curve

Conclusions

1) The number and overall trend of guided wave curves remain consistent across the three models
2) The presence of a fastener system induces a bandgap phenomenon in the track structure
3) The fastener system increases the cutoff frequency of each guided wave mode in the track.