

VINO for Structural Simulation and Structural Health Monitoring

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Background

- The percentage of 50-year-old bridges will be over 50% in years to come
- The growth of Sensor Tech. and Machine Learning may be more suitable
- ❖ However, data from Finite Element (FE) models may be inaccurate and the precise supervised machine learning approaches need measured damage data

Objectives

- Propose VINO to learn mappings between damage field and structural responses, which only utilize data from a bridge at the healthy state to predict the bridge at the damaged states
- Examine VINO numerically and experimentally in structural simulation and SHM

Approach

- Establish Vehicle-Bridge Interaction (VBI) numerical and experimental dataset
- Train and test the Fourier Neural Operator (FNO) by numerical data
- Fine-tune by experimental healthy data. Validate by experimental damage data

Publication Plan

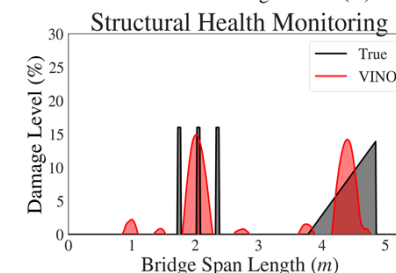
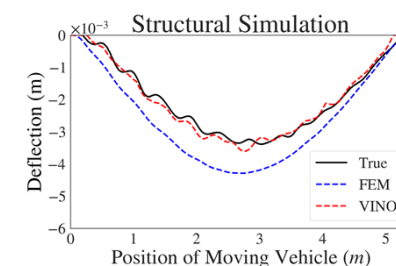
- Automation in Construction

Keywords: FNO, Damage field, Structural responses

Results



Experimental Bridge



- Forward VINO for structural simulation is more accurate and faster than FE model once it is trained
- Inverse VINO for SHM can determine, localize, and quantify damages from structural responses