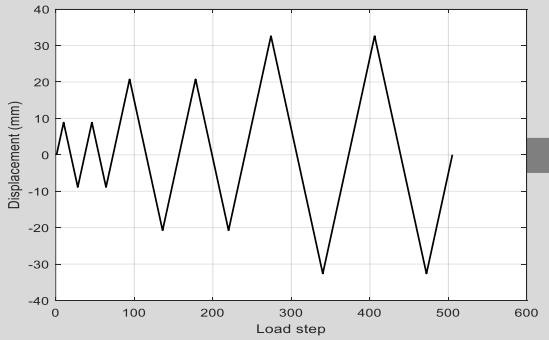
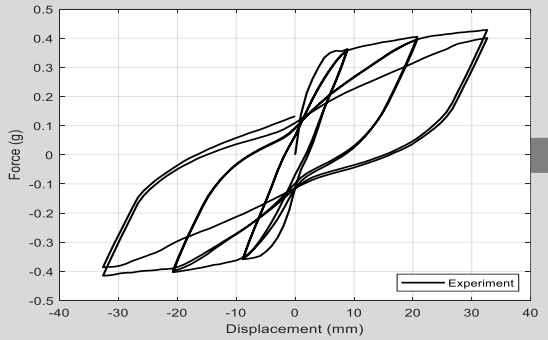
Modeling RC columns as an equivalent SDOF

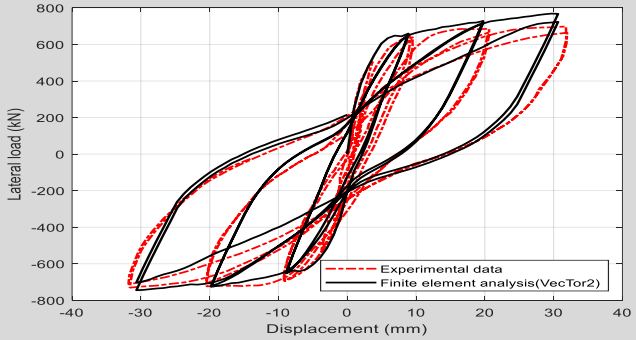


Input loading protocol

Reinforced concrete column

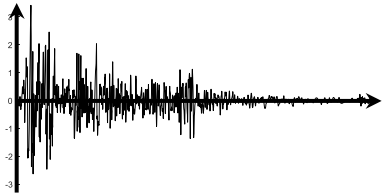


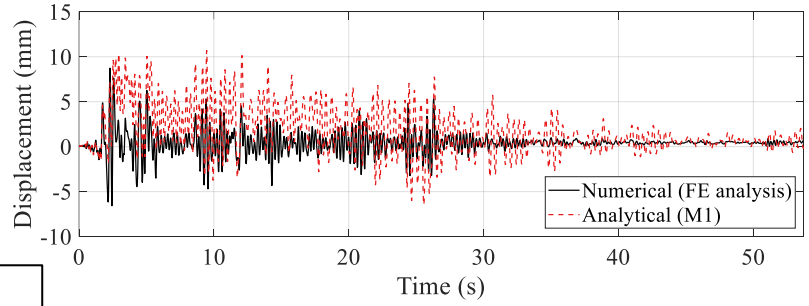
Experimental results (Force-Displacement)



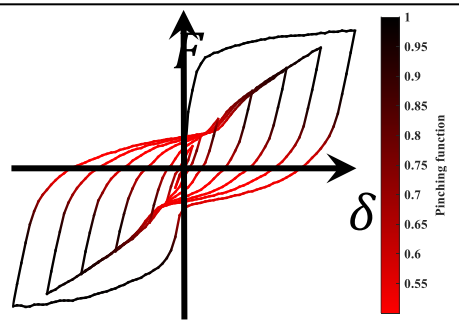
Estimate a mathematical model that fits the results

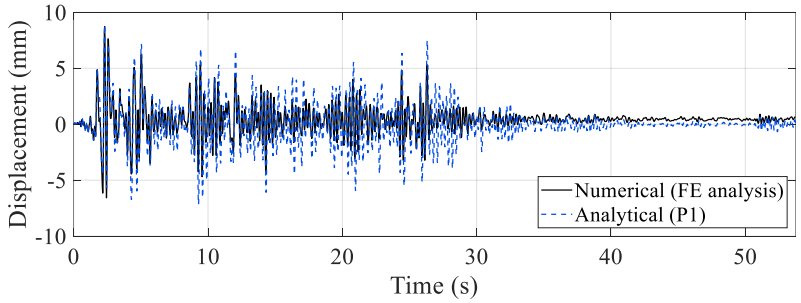
★ **Does the estimated model accurately predict the response under different loading conditions?**



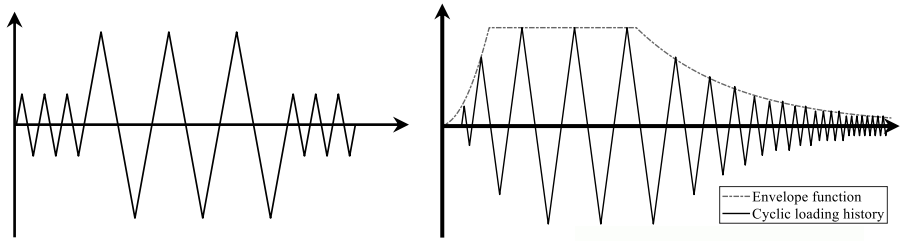


1. Precise model for RC columns



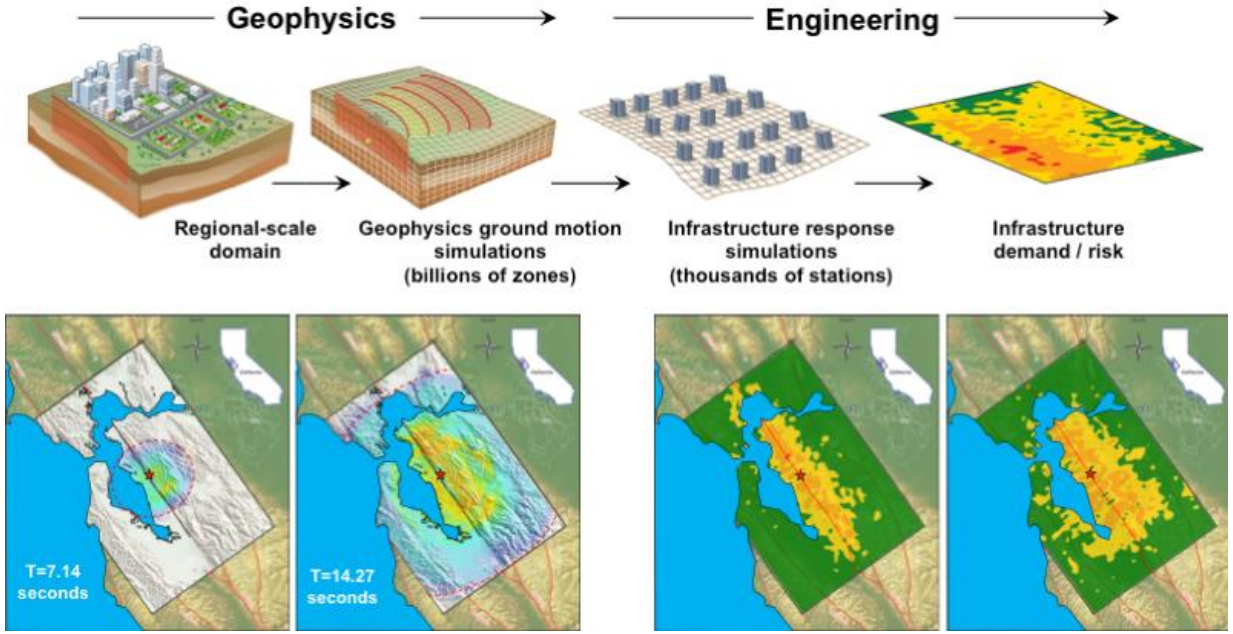


2. Optimal input loading history

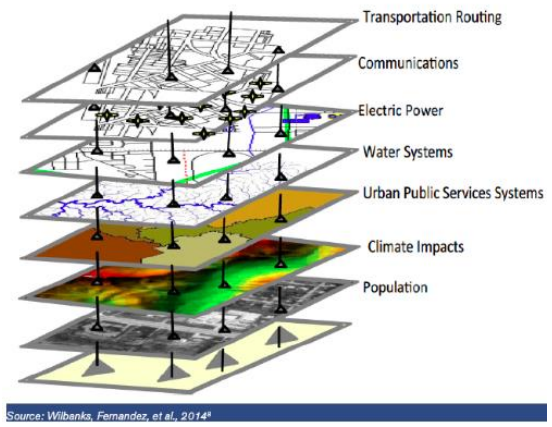


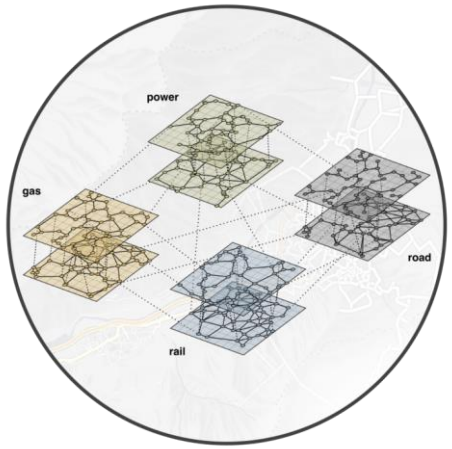
- Developed CNN models to estimate BW parameters
- Now experimenting with several candidate loading histories

Regional seismic simulations



Complex system

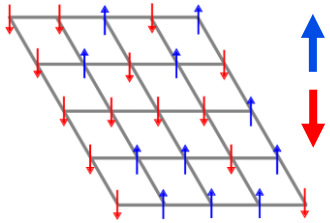




Connection to statistical mechanics

Renormalization group theory – a systematic framework to study the behavior of complex systems across multiple scales

As a first step,



Ising model

$$P = \frac{1}{Z}\exp\left(\frac{1}{kT}\left(\sum_{i=1}^{n} h_i x_i + \sum_{i>j} J_{ij} x_i x_j\right)\right)$$

x_i: Damage state of the ith building (Safe: $+1$ & Collapsed: -1)

P: **Joint probability** for the region to have the configuration $\{x_1, x_2, \ldots, x_n\}$