

Deep learning in SHM and beyond

Topic: Deep learning in structural engineering

TITLE: Deep learning for inverse eigenvalue problems

RESEARCH BACKGROUND:

Eigenvalue problems are common in engineering applications. For example, computing the eigenvalues and eigenmodes of structures is paramount for understanding their dynamic response to external loads. Solving the inverse eigenvalue problem could be even more interesting. In fact, this process would allow designing structures so that their eigenvalues satisfy user-defined requirements.

RESEARCH ACTIVITIES:

1. Literature review of methods for solving inverse eigenvalue problems.
2. Implementation of simple methods and evaluation through case studies in the field of structural engineering.
3. Development of a new solution based on physics-informed machine learning and design of a new metamaterial for controlling wave propagation.

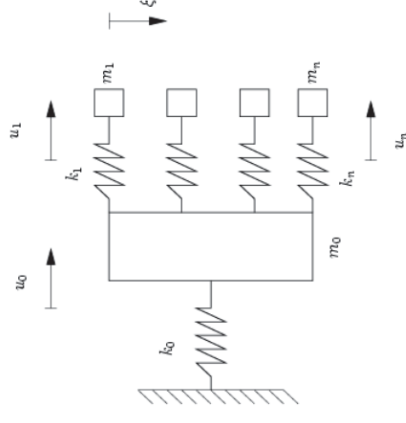
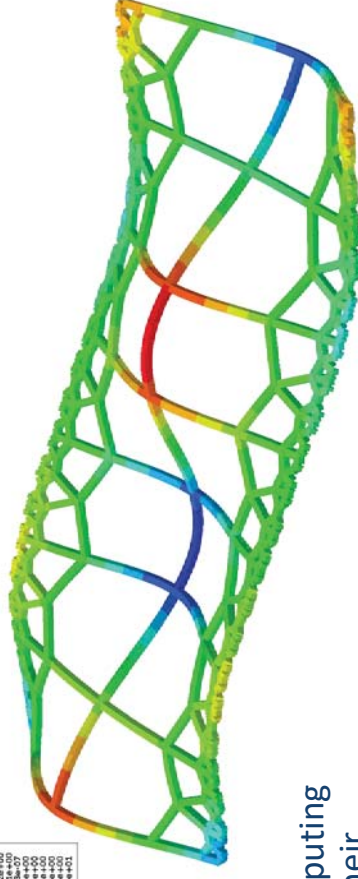
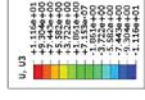
METHODOLOGY: Analytical – Numerical

DURATION: 7-9 months

CONTACTS:

francesco.cadini@polimi.it

marco.giglio@polimi.it



$$f(\mathbf{p}) = \begin{bmatrix} \lambda_1(\mathbf{p}) - \lambda_1^* \\ \vdots \\ \lambda_{n+1}(\mathbf{p}) - \lambda_{n+1}^* \end{bmatrix}, \quad g(\mathbf{p}) = \begin{bmatrix} \det(\tilde{K}(\mathbf{p}) - \tilde{\lambda}_1 \mathbf{I}_n) \\ \vdots \\ \det(\tilde{K}(\mathbf{p}) - \tilde{\lambda}_n \mathbf{I}_n) \end{bmatrix}.$$