Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

Projection-based and data-driven parametric model order reduction for the analysis of periodic structures

Project Characteristics

Modeling:
Mathematics:
Programming:
Science:

Task

- get familiar with projection-based model order reduction (MOR) approaches for the Wave Finite Element Method [1] and implement them in combination with a parametric MOR (pMOR) method [2]
- get familiar with data-driven pMOR methods for the dispersion relation [3] and implement them
- compare the implemented approaches with respect to their accuracy and their computational effort

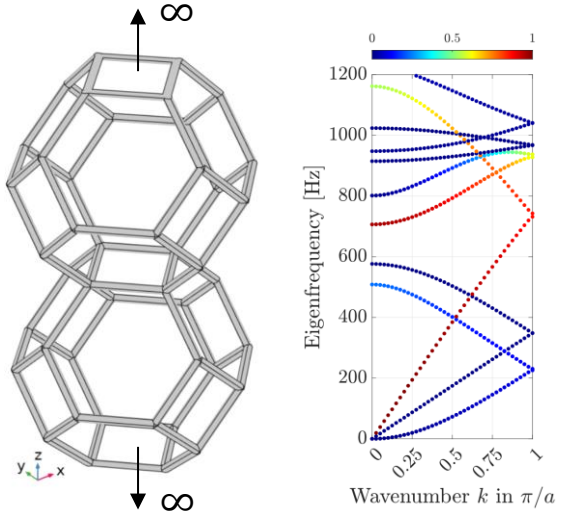
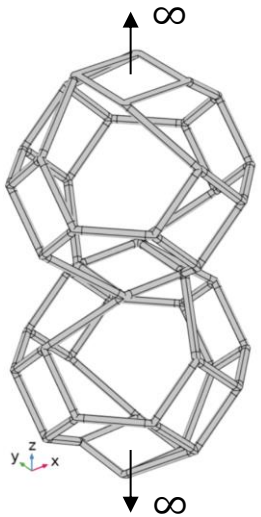


Fig 1: Unit cell with 0° degree twist and corresponding dispersion curve [4]



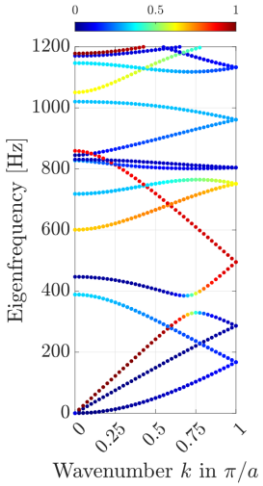
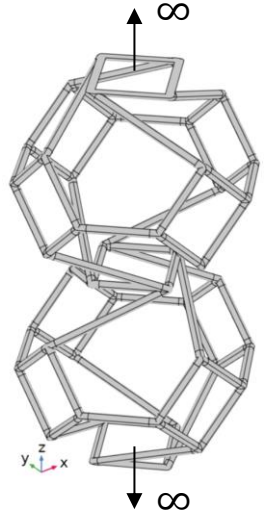


Fig 2: Unit cell with 45° degree twist and corresponding dispersion curve [4]



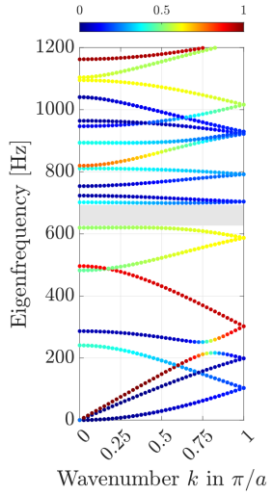


Fig 3: Unit cell with 90° degree twist and corresponding dispersion curve [4]

[1] Krattiger, D., & Hussein, M. I. (2014). Bloch mode synthesis: Ultrafast methodology for elastic band-structure calculations. *Physical Review E*, *90*(6), 063306.
[2] Benner, P., Gugercin, S., & Willcox, K. (2015). A survey of projection-based model reduction methods for parametric dynamical systems. *SIAM review*, *57*(4), 483-531.
[3] Alghamdi, M. M., Bertrand, F., Boffi, D., Bonizzoni, F., Halim, A., & Priyadarshi, G. (2022). On the matching of eigensolutions to parametric partial differential equations. *arXiv preprint arXiv:2207.06145*.
[4] Kleine-Wächter, L., Rumpler, R., Mao, H., Göransson, P., & Müller, G. (2022). Numerical study of Kelvin cells for the design of periodic lattice metamaterials. In *International Conference on Noise and Vibration Engineering (ISMA)*.