Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
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Modeling:
Mathematics:
Programming:
Science:

Software Lab:

Model order reduction for bolted joints by hyper-reduction and machine learning

Description

Tasks such as uncertainty quantification or optimization often require running multiple finite element simulations, which are usually very computationally expensive [1]. Hyperreduction methods such as Energy Conserving Sampling and Weighting (ECSW) and Discrete Empirical Interpolation (DEIM) can simplify the nonlinear finite element models, reducing complexity and speeding up these analyses [2]. Integrating Convolutional Autoencoders (CAE) can further improve performance by reducing the system to a lower dimensional space, capturing spatial patterns and nonlinearities [3]. The target of the project is to assess the feasibility of the presented Model Order Reduction (MOR) method for contact nonlinearity problems.

Task

- Literature review on Hyperreduction and Autoencoder algorithms
- Modelling of bolted connection with FEM
- Implementation of selected MOR workflow

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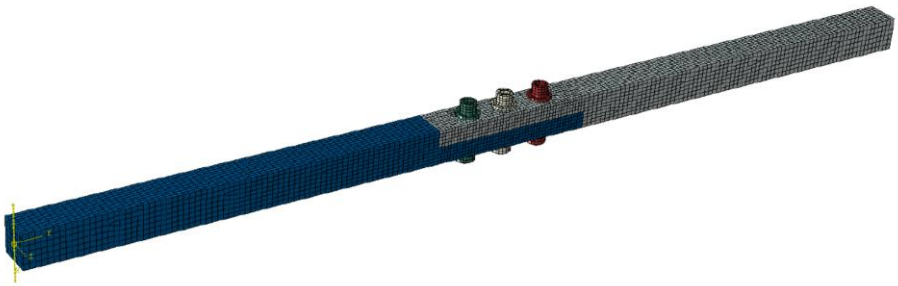

Finite element model of the Brake-Reuss beam. [4]

References

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[4] Gross, J., Armand, J., Lacayo, R. M., Reuß, P., Salles, L., Schwingshackl, C. W., ... & Kuether, R. J. (2016). A numerical round robin for the prediction of the dynamics of jointed structures. In Dynamics of Coupled Structures, Volume 4: Proceedings of the 34th IMAC, A Conference and Exposition on Structural Dynamics 2016 (pp. 195-211). Springer International Publishing.