



Master Thesis

Redundancy Distribution in Reduced Models

The concept of redundancy matrices in discrete truss structures is well-described in literature [1, 2]. The redundancy matrix contains information about the distribution of statical indeterminacy, i.e. of internal constraint. This information is valuable especially in the design and analysis of adaptive structures [3, 4]. Further research towards design and analysis of adaptive surface structures is needed when dealing with structures in continuous space [2], especially in statically indeterminate structural theories like e.g. 2d-elasticity.

The aims of this thesis are (1) investigating the redundancy distribution of discrete structures which are reduced by means of statical and geometrical condensation methods, respectively, and (2) redundancy matrices of structures modeled with different structural models (like e.g. beam-like structures modeled with 2d finite elements).

Specific tasks are

- Investigating the concept of redundancy matrices in truss structures with application in adaptive structures
- Computing redundancy matrices in reduced models by means of statical and geometrical condensation methods, respectively
- Studying properties of redundancy matrices (e.g. eigenspace, idempotence) w.r.t. different structural models

Interested in

Structural mechanics, adaptive structures, Maple/Matlab

Literature

- [1] Bahndorf, J.: *Zur Systematisierung der Seilnetzrechnung und zur Optimierung von Seilnetzen*. Doctoral Thesis, Universität Stuttgart, Stuttgart, 1991.
- [2] von Scheven, M., Ramm, E. and Bischoff, M.: *Quantification of the Redundancy Distribution in Truss and Beam Structures*. IJSS, under review, 2020.
- [3] Geiger, F., Gade, J., von Scheven, M. and Bischoff, M.: *Anwendung der Redundanzmatrix bei der Bewertung adaptiver Strukturen*. 14. Baustatik-Baupraxis, Stuttgart, 23-24 March 2020.
- [4] Wagner, J.L., Gade, J., Heidingsfeld, M., Geiger, F., von Scheven, M., Böhm, M., Bischoff, M. and Sawodny, O.: *On steady-state disturbance compensability for actuator placement in adaptive structures*. at – Automatisierungstechnik (2018) 66:591–603.