CAD-integrated Multi-Stage Structural Analysis

Anna M. Bauer*, Roland Wüchner and Kai-Uwe Bletzinger

* Chair of Structural Analysis
Technical University of Munich
Arcisstr. 21, 80333 München, Germany
e-mail: am.bauer@tum.de, web page: https://www.st.bgu.tum.de

ABSTRACT

One of the fundamental motivations of Isogeometric Analysis (IGA) is a workflow which is directly integrated into Computer Aided Design (CAD). It avoids tedious conversions between the geometry and analysis model which is most critical for a repeated or iterative process. However, the choice of basis functions not only affects the generation of the simulation model from the geometry model but also the way back. If the solution is directly provided by CAD-inherent NURBS, the result can be processed with the same CAD functionalities as the initial models.

This becomes very beneficial in the context of a multi-stage structural analysis. The results from a previous computation are still available or exactly transferable and not corrupted by an approximation. Initial displacements can directly be used in the context of large displacements. This is more accurate than the common approach of applying initial stresses on an updated geometry which loses track of the initial configuration [1]. Additional structural parts, load or support conditions can be added or removed depending on the deformed geometry in CAD. As the simulation model is available in CAD and not dependent on matching parametrizations [2] one can go even further and include the isogeometric model in an automated, parametric workflow with several consecutive, dependent analyses. Every change at a certain point in the process will automatically update the downstream analyses and results.

This contribution will elaborate the advantages of isogeometric analysis within the scope of multi-stage simulation. The framework of the Rhino plug-ins TeDA [3] and Kiwi!3D [4] will be presented in order to show the potentials of staging within a parametric design environment.

REFERENCES

[1] A.M. Bauer, P. Längst, R. Wüchner and K.-U. Bletzinger Isogeometric, "Analysis for Modeling and Simulation of Building Processes", *Proceedings of the IASS Annual Symposium 2017*, Annette Bögle, Manfred Grohmann (eds.), 2017.

[2] A.M. Bauer, M. Breitenberger, B. Philipp, R. Wüchner and K.-U. Bletzinger, "Embedded structural entities in NURBS-based isogeometric analysis", *Comput. Methods Appl. Mech. Engrg.*, Vol. **325**, pp. 198-218 (2017).

[3] Chair of Structural Analysis, *Tool to enhance Design by Analysis (TeDA)* https://www.st.bgu.tum.de/en/software/research/teda/, 2019.

[4] Chair of Structural Analysis and str.ucture GmbH, *Kiwi!3D* https://www.kiwi3d.com/, 2019.