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# THE POTENTIALS OF ISOGEOMETRIC B-REP ANALYSIS FOR THE DESIGN OF ADAPTIVE STRUCTURES

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Active-bending is a construction technique which uses thin and flexible elements. By joining elements with bending stiffness and very thin-walled structures in membrane action one gains a complete structure, which can either be very stiff or very flexible, depending on the specific set-up. This principle can be very effective and allows new types of design. However, the design and simulation process is very complicated since shape and stresses are highly interacting and the structures show a nonlinear behaviour. A change at one specific point often influences the whole structure, which requires in turn an integral design process. Isogeometric analysis is a suitable answer to this problem, since the structural analysis can be included into the CAD environment and adjustments are easily possible due to the independence of parametrization. Furthermore, simultaneous parametric design of geometric and structural properties is available.
Adaptive structures face the same challenges, since several different aspects such as aesthetics, structural behaviour, and movement analysis, have to be considered in the design. Moreover, active-bending elements and adaptive structures, e.g. in façades, can be combined. This was successfully proven in e.g. the kinematic façade of the Thematic Pavilion EXPO 2012 "One Ocean" [1].

The potentials of isogeometric analysis in an integral design process are presented for the example of active-bending structures. This approach was implemented into the parametric design environment Grasshopper™. The direct mechanical response of a structure to loads and possible actuators is given within CAD for further evaluation. Design-through-Analysis opens up new possibilities for the development and design of structural systems beside the traditional concepts.

## REFERENCES

[1] J. Knippers, H. Jungjohann, F. Scheible and M. Oppe, Bio-inspirierte kinetische Fassade für den Themenpavillon "One Ocean" EXPO 2012 in Yeosu, Korea. *Bautechnik*, Vol. **90**, pp. 341–347, 2013.