Design of Architectural Membranes with Isogeometric Elements

Abstract:
The recently introduced Isogeometric Analysis presents interesting advantages compared to classical FE discretizations, mainly w.r.t. the use of the same model for the design and the analysis of structures. Architectural membranes with their smoothly curved silhouette on the one hand and the large number of iterative design steps between esthetical and engineering requirements are ideally suited for the use of the Isogeometric Analysis. A brief introduction to the Isogeometric Analysis is given and the development of a membrane element, suitable for form-finding of architectural membranes, is outlined. As a well-established form-finding approach, the Updated Reference Strategy is used. The developed IGA-based membrane element is benchmarked at the example of Costa’s minimal surface, making prove of the robustness and accuracy of the developed element and the applied form-finding approach. Advantages for the design of architectural membranes by using IGA elements are demonstrated and discussed. Remarks on the current state of CAD-CAE-integration are made. An outlook on future research in the field of Isogeometric Analysis for architectural membrane closes this contribution.

Stichworte:
textile membranes, tensile structures, form-finding, Isogeometric Analysis, IGA, CAD-CAE-integration

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