The interaction of geometry and mechanical behavior with IBRA

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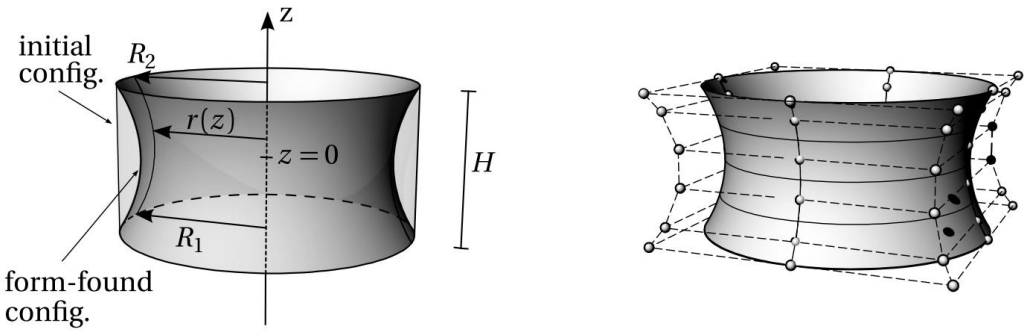
ABSTRACT

Architectural membranes provide minimal use of material combined with an attractive and impressive language of shapes. These shapes are directly mechanically motivated: based on the chosen pre-stress level and the boundary conditions, form-finding analysis is used to determine the shape of equilibrium which allows the membrane to act in pure tension. This mechanical background leads to an iterative design procedure, where the mechanical form-finding and the modification of boundary conditions as design handles mutually interact until a solution that is desirable from a structural as well as from an esthetical point of view is found.

Classically the architectural part of a membrane structure's design is performed within a CAD environment, whereas the form-finding and analysis are performed within an FE-code. The separation of these models requires considerable amounts of time and is obviously rather error-prone. Recently, the *isogeometric B-Rep analysis* (IBRA) has been proposed as a consequent generalization of IGA with the aim of directly using the CAD-model – enriched by mechanical information – for the analysis of structures [1]. IBRA has successfully been applied to the form-finding and analysis of structural membranes, too [2,3].



In the present contribution, on the one hand possibilities and benefits of the application of IBRA to structural membranes will be discussed. On the other hand, a critical assessment of limits and weaknesses of the method shall provide the basis for a better choice of the analysis approach – classical FEM or IBRA – that fits different needs. Therefore, relevant academic and real life examples will be discussed with their implications on modelling and analysis.

REFERENCES

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