

Isogeometric shape optimisation of shell structures using multiresolution subdivision surfaces

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Abstract. We introduce the isogeometric shape optimisation of thin shell structures using subdivision surfaces. Both triangular Loop and quadrilateral Catmull-Clark subdivision schemes are considered for geometry modelling and finite element analysis. A gradient-based shape optimisation technique is implemented to minimise compliance, i.e. to maximise stiffness. Different control meshes describing the same surface are used for geometry representation, optimisation and finite element analysis. The finite element analysis is performed with subdivision basis functions corresponding to a sufficiently fine control mesh. During iterative shape optimisation the geometry is updated starting from the coarsest control mesh and proceeding to increasingly finer control meshes. The proposed approach is applied to three optimisation examples, namely a catenary, a roof over a rectangular domain, and free-form architectural shell roof. The influence of the geometry description and the used subdivision scheme on the obtained optimised curved geometries are investigated in detail.

References

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