

Isogeometric Shape Optimization of Trimmed Shell Structures

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In the present work, isogeometric shape optimization of trimmed shell structures is performed. In structural analysis and shape optimization, a complex or trimmed shell structure is needed to be constructed with multiple untrimmed patches by using conventional isogeometric analysis. To deal with this inconvenience and the consequential disadvantages, trimmed surface analysis (TSA) [1], which directly utilizes the information of untrimmed shell surface and trimming curves from CAD program to analysis without constructing multiple patches is employed to isogeometric analysis and shape optimization of trimmed shell structures. Using trimmed surface analysis for shape optimization has advantages of not only representing exact geometry, but also eliminating remeshing tasks in the optimization process. In addition, a topologically complex shell geometry can be treated efficiently without constructing multiple patches and the optimal shape of the trimmed shell can have smooth geometry. The coordinates of control points of both the shell surface and the trimming curves are defined as the design variables so that the shell surface and trimmed boundaries can be changed in the optimization process. For optimization algorithm, method of moving asymptotes (MMA) which is gradient based algorithm is employed. The various types of design area and moving directions of design variables are studied. A number of examples for shape optimization of trimmed shell structures are performed by the proposed method.

REFERENCES

- [1] H. J. Kim, Y. D. Seo and S. K. Youn, Isogeometric Analysis for Trimmed CAD Surface, *Comput. Methods Appl. Mech. Engrg.*, Vol. **198**, pp. 2982~2995. 2009.
- [2] Y.-D. Seo, H.-J. Kim, and S.-K. Youn, Shape optimization and its extension to topological design based on isogeometric analysis, *Int. J. Solids Struct.*, Vol. **47**, no. 11–12, pp. 1618–1640, 2010.