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Editorial

Isogeometric design and analysis

Isogeometric analysis (IGA) aims to bridge the geometric divide between CAD systems and FEA software tools. It is founded on the idea of using the same basis functions to represent the CAD geometry and to approximate the physical quantities appearing in analysis. It promises to revolutionize the design and analysis processes for automobile, aerospace and marine industry by eliminating the need for model conversion, approximation and meshing.

Over the last decade, research in isogeometric design and analysis has undergone tremendous growth and has led to substantial progress in both computer-aided design and finite element analysis fields. Different geometric representations such as NURBS, T-splines, triangular splines and subdivision surfaces have been investigated for use in isogeometric analysis. In particular, various volume parameterization techniques have been developed for isogeometric analysis. Further, tighter integration of CAD and analysis through isogeometric analysis has empowered applications in shape optimization.

The objective of this special issue is to capture the state-of-the-art regarding the theoretical foundations, the computational methods, and the applications of isogeometric analysis and its integration with CAD. In this issue, we present thirteen articles in several topic areas, including domain parameterization, quadrature rules, shape optimizations, new IGA methods and novel IGA applications.

On domain parameterization, *Buchegger and Jüttler* presented a patch adjacency graph based approach to planar multi-patch domain parameterization. *Sauer* et al. proposed to create volumetric mesh from T-spline surfaces through a T-spline boundary zone beneath the surface. *Chan* et al. proposed an approach for constructing spline representation of a domain of interest from voxel-based data through PHT-spline represented level set. *Lei* et al. developed a volume preserving mesh parameterization approach based on optimal mass transportation.

On quadrature, *Barton and Calo* presented Gauss–Galerkin quadratures for quadratic and cubic spline spaces based on the homotopy continuation concept.

On shape optimization, *Wang* et al. presented normalization approaches for the descent search direction in isogeometric shape optimization. *Kostas* et al. presented an isogeometric BEM solver based procedure for shape optimization of 2D hydrofoils. *Cho* et al. developed an isogeometric topological shape optimization approach with dual evolution of NURBS curves and level sets.

New isogeometric design and analysis methods are being developed. *Pelosi* et al. presented the use of spline spaces over regular triangulations as a tool for isogeometric Galerkin methods. *Upreti and Subbarayan* developed procedures for using signed algebraic level sets to integrate CAD and CAE.

Finally, on novel IGA applications, *Wang* et al. presented the application of isogeometric methods to free vibrations of Reissner–Mindlin plates. *Casquero* et al. presented arbitrary-degree T-splines based isogeometric analysis of fully nonlinear Kirchhoff–Love shells with the goal of closer integration of design and analysis of shell structures. *Khakalo and Niiranen* presented commercial software based implementation of isogeometric approach for analyzing higher-order gradient elasticity problems.

We want to take this opportunity to thank Prof. Vadim Shapiro for inviting us to edit this issue and the tireless assistance from the journal editorial staff. We also want to thank all the authors for submitting their exciting work. Last, we are indebted to reviewers for their invaluable suggestions and comments that have improved the papers significantly.

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