

数学与系统科学研究院

计算数学所学术报告

报告人: **Prof. Jessica Zhang**

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of Biomedical Engineering, Carnegie Mellon University, USA)*

报告题目:

**Volumetric Spline Parameterization
for Isogeometric Analysis with
Industry Applications**

邀请人: 陈冲 博士

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下午 15:00-16:00

报告地点: 科技综合楼三层

311 报告厅

Abstract:

As a new advancement of traditional finite element method, isogeometric analysis (IGA) adopts the same set of basis functions to represent both the geometry and the solution space, integrating design with analysis seamlessly. In this talk, I will present our latest research on volumetric spline parameterization for IGA applications. For arbitrary objects, a new centroidal Voronoi tessellation (CVT) based surface segmentation method is developed to build polycubes whose topology is equivalent to the input geometry. First, eigenfunctions of the secondary Laplace operator (SLO) are coupled with the harmonic boundary-enhanced CVT (HBECVT) model to classify vertices of the surface into several components based on concave creases and convex ridges of an object. For each segmented component, we then apply the skeleton information to define local coordinates and include them into the HBECVT model to further segment it into several patches, with predefined geometric constraints applied for valid polycube construction. Based on the constructed polycube, we obtain volumetric control meshes via parametric mapping. After that, truncated hierarchical spline basis functions are derived to enable analysis-suitability, including partition of unity and linear independence. Furthermore, a blended B-spline approach is recently developed to construct basis functions around extraordinary nodes, achieving an optimal convergence rate of IGA. The developed pipelines have been incorporated into commercial software such as Rhino, Abaqus and LS-DYNA for industry applications.

报告人简介:

Jessica Zhang is a Professor of Mechanical Engineering at Carnegie Mellon University with a courtesy appointment in Biomedical Engineering. She received her B.Eng. in Automotive Engineering, and M.Eng. in Engineering Mechanics from Tsinghua University, China; and M.Eng. in Aerospace Engineering and Engineering Mechanics and Ph.D. in Computational Engineering and Sciences from Institute for Computational Engineering and Sciences (ICES), The University of Texas at Austin. After staying two years at ICES as a postdoctoral fellow, she joined CMU in 2007 as an assistant professor, and then was promoted to an associate professor in 2012 and a full professor in 2016. Her research interests include computational geometry, mesh generation, computer graphics, visualization, finite element method, isogeometric analysis and their application in computational biomedicine, material sciences and engineering. She has co-authored over 150 publications in peer-reviewed journals and conference proceedings, and received the Best Paper Award 1st Place in Solid and Physical Modeling Conference 2018, Autodesk Best Paper Award 1st Place in SIAM Conference on Solid and Physical Modeling 2015, the Best Paper Award in CompIMAGE'16 conference and one of the 5 Most Highly Cited Papers Published in Computer-Aided Design during 2014-2016. She published a book entitled "Geometric Modeling and Mesh Generation from Scanned Images" with CRC Press, Taylor & Francis Group in 2016. She is the recipient of ELATE Fellow at Drexel, Presidential Early Career Award for Scientists and Engineers, NSF CAREER Award, Office of Naval Research Young Investigator Award, USACM Gallagher Young Investigator Award, Clarence H. Adamson Career Faculty Fellow in Mechanical Engineering, George Tallman Ladd Research Award, and Donald L. & Rhonda Struminger Faculty Fellow.

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