

CS Seminar

Volumetric Representations: the Geometric Modeling of the Next Generation

Professor Gershon Elber
Department of Computer Science
Technion

Date:

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3:00 pm

Venue:

Room 308
Chow Yei Ching Building
The University of Hong Kong

Abstract:

The needs of modern (additive) manufacturing (AM) technologies can be satisfied no longer by boundary representations (B-reps), as AM requires the representation and manipulation of interior fields and materials as well. Further, while the need for a tight coupling between design and analysis has been recognized as crucial almost since geometric modeling (GM) has been conceived, contemporary GM systems only offer a loose link between the two, if at all. For about half a century, (trimmed) Non Uniform Rational B-spline (NURBs) surfaces has been the B-rep of choice for virtually all the GM industry. Fundamentally, B-rep GM has evolved little during this period. In this talk, we seek to examine an extended (trimmed) NURBs volumetric representation (V-rep) that successfully confronts the existing and anticipated design, analysis, and manufacturing foreseen challenges. We extend all fundamental B-rep GM operations, such as primitive and surface constructors and Boolean operations, to trimmed trivariate V-reps. This enables the much needed tight link to (Isogeometric) analysis on one hand and the full support of (heterogeneous and anisotropic) additive manufacturing on the other. Special capabilities toward the support of modern AM and the support of Isogeometric analysis will also be presented, that enable robust queries over the V-reps, including volumetric covering by curves, precise contact analysis, maximal penetration depth, and accurate integration over trimmed domains. Examples and other applications of V-rep GM, including AM and lattice- and micro- structure synthesis (with heterogeneous materials) will also be demonstrated. In collaboration with many others, including Ben Ezair, Fady Massarwi, Boris van Sosin, Jinesh Machchhar, Annalisa Buffa, Giancarlo Sangalli, Pablo Antolin, Massimiliano Martinelli, Stefanie Elgeti, and Robert Haimes.

About the Speaker:

Gershon Elber is a professor in the Computer Science Department, Technion, Israel. His research interests span computer aided geometric designs and computer graphics. Prof. Elber received a BSc in computer engineering and an MSc in computer science from the Technion, Israel in 1986 and 1987, respectively, and a PhD in computer science from the University of Utah, USA, in 1992. He is a member of SIAM and the ACM. Prof. Elber has served on the editorial board of the Computer Aided Design, Computer Graphics Forum, The Visual Computer, Graphical Models, and the International Journal of Computational Geometry & Applications and has served in many conference program committees including Solid Modeling, Shape Modeling, Geometric Modeling and Processing, Pacific Graphics, Computer Graphics International, and Siggraph. Prof. Elber was one of the paper chairs of Solid Modeling 2003 and Solid Modeling 2004, one of the conference chairs of Solid and Physical Modeling 2010, the chair of GDM 2014, the conference co-chair of SIAM GD/SPM 2015, and the conference co-chair of SPM 2018. He has published over 200 papers in international conferences and journals and is one of the authors of a book titled "Geometric Modeling with Splines - An Introduction". Prof. Elber received the John Gregory Memorial Award, 2011, in "Appreciation for Outstanding Contributions in Geometric Modeling", the Solid Modeling Association pioneers award in 2016, and the Bezier award in 2019. Elber can be reached at the Technion, Israel Institute of Technology, Department of Computer Science, Haifa 32000, ISRAEL. Email: gershon@cs.technion.ac.il, Fax: 972-4-829-5538.

All are welcome!

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