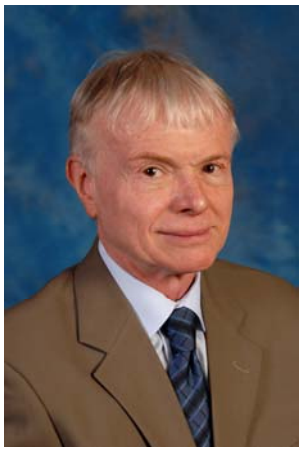
The Raymond D. Mindlin Lecture

Department of Civil Engineering & Engineering Mechanics, Columbia University
Engineering Mechanics Committee, ASCE Metropolitan Section
Engineering Mechanics Institute, ASCE

Isogeometric Analysis



Professor Thomas J. R. Hughes

Institute for Computational Engineering and Sciences
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April 25, 2013 (6:30-7:30 pm)
Davis Auditorium, Schapiro Center, Columbia University

Abstract: Computational geometry has until very recently had little impact upon the numerical solution of partial differential equations. The purpose of this talk is to explore Isogeometric Analysis, in which NURBS (Non-Uniform Rational B-Splines) and T-Splines are employed to construct exact geometric models [1,2] of complex domains. I will review recent progress toward developing integrated Computer Aided Design (CAD)/Finite Element Analysis (FEA) procedures that do not involve traditional mesh generation and geometry clean-up steps, that is, the CAD file is directly utilized in analysis. I will summarize some of the mathematical developments within Isogeometric Analysis that confirm the superior accuracy and robustness of spline-based approximations compared with traditional FEA, and I will present sample applications to problems of solids, structures and fluids.

References

T.J.R. Hughes, J.A. Cottrell and Y. Bazilevs, Isogeometric Analysis: CAD, Finite Elements, NURBS, Exact Geometry and Mesh Refinement, Computer Methods in Applied Mechanics and Engineering, 194, (2005) 4135-4195.

J.A. Cottrell, T.J.R. Hughes and Y. Bazilevs, Isogeometric Analysis: Toward Integration of CAD and FEA, Wiley, Chichester, U.K., 2009.

Biosketch: Thomas J.R. Hughes holds B.E. and M.E. degrees in Mechanical Engineering from Pratt Institute and an M.S. in Mathematics and Ph.D. in Engineering Science from the University of California at Berkeley. He taught at Berkeley, Caltech and Stanford before joining the University of Texas at Austin. At Stanford he served as Chairman of the Division of Applied Mechanics, Chairman of the Department of Mechanical Engineering, Chairman of the Division of Mechanics and Computation, and occupied the Crary Chair of Engineering. At Austin he is Professor of Aerospace Engineering and Engineering Mechanics and holds the Computational and Applied Mathematics Chair III. He is a Fellow of the American Academy of Mechanics, ASME, AIAA, ASCE, AAAS, a Founder, Fellow and past President of USACM and IACM, past Chairman of the Applied Mechanics Division of ASME, past Chairman of the US National Committee on Theoretical and Applied Mechanics, and co-editor of the international journal Computer Methods in Applied Mechanics and Engineering.

Dr. Hughes is one of the most widely cited authors in Engineering Science. He has received the Huber Prize and Von Karman Medal from ASCE, the Timoshenko, Worcester Reed Warner, and Melville Medals from ASME, the Von Neumann Medal from USACM, the Gauss-Newton Medal from IACM, the Computational Mechanics Award of the Japan Society of Mechanical Engineers, the Grand Prize from the Japanese Society of Computational Engineering and Sciences, and the Humboldt Research Award for Senior Scientists from the Alexander von Humboldt Foundation.

He is a member of the US National Academy of Sciences, the US National Academy of Engineering, the American Academy of Arts and Sciences, the Academy of Medicine, Engineering and Science of Texas, and a Foreign Member of the Royal Society of London, the Austrian Academy of Sciences, and the Istituto Lombardo Accademia di Scienze e Lettere. Dr. Hughes has received honorary doctorates from the universities of Louvain, Pavia, Padua, Trondheim, and Northwestern.

ENGINEERING MECHANICS INSTITUTE

ASCE METROPOLITAN SECTION

The Department of Civil Engineering and Engineering Mechanics established the Mindlin Lecture to honor the pioneering contributions of Prof. Raymond D. Mindlin to the field of applied mechanics. His research encompassed photoelasticity and experimental mechanics; classical three-dimensional elasticity (e.g., Mindlin's problem); generalized elastic continua (strain-gradient and couple-stress theory); frictional contact and granular media; waves and vibrations in isotropic and anisotropic plates (Mindlin's Plate Theory); wave propagation in rods and cylinders; theory of electro-elasticity and piezoelectric crystal resonators, and crystal lattice theories.

A member of the National Academy of Engineering and the National Academy of Sciences, Prof. Mindlin received the National Medal of Science for applied mechanics and mathematics in 1979. He had been awarded the Medal for Merit in 1946, by President Harry S. Truman, for his work in developing the radio proximity fuse, a detonator for weapons used in offensive warfare that was a significant factor in World War II. ASCE created the **Mindlin Medal** in 2009.

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