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Ernst Melan-Lectures

Beginning October 2016, the Institute for Mechanics of Materials and Structures (IMWS), the Department of Civil Engineering, and the Center for Geometry and Computational Design at Vienna University of Technology are establishing a new Distinguished Lecture Series in the Engineering Sciences, named Ernst Melan-Lectures.

Ernst Melan (* 1890, in Brünn/Brno, † 1963, in Vienna) was a pioneer of engineering mechanics in the 1st half of the 20th century. As professor of elasticity theory, structural mechanics, and building construction at TU Wien from 1925 to 1962, he has sustainably shaped the culture of teaching and research at this university, where he has also held the positions of department head („Dekan“) and president („Rektor“). Among his numerous contributions to the engineering sciences, his shake-down theorem, as of 1936, and his general treatise of elastoplasticity, as of 1938, both anticipating many ideas which were hardly discussed before the 1950s, are true landmarks in the history of theoretical and applied mechanics.

We are pleased to announce that the inaugural Ernst Melan-Lecture at TU Wien will be given

by

Prof. Thomas J.R. Hughes
Peter O'Donnell Jr. Chair in Computational and Applied Mathematics
Institute for Computational Engineering and Sciences (ICES)
The University of Texas at Austin, 201 East 24th Street, Austin, Texas 78712, USA
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Prof. Hughes will talk about **Isogeometric Analysis: Past, Present, Future**

on

October 5th, 2016; 2:00 p.m.
Technische Universität Wien, Karlsplatz 13, 1040 Vienna
HS 8 Heinz Parkus (7th Staircase, Ground Level)

Isogeometric Analysis: Past, Present, Future

Abstract:

October 1, 2015 marked the tenth anniversary of the appearance of the first paper [1] describing my vision of how to address a major problem in Computer Aided Engineering (CAE). The motivation was as follows: Designs are encapsulated in Computer Aided Design (CAD) systems. Simulation is performed in Finite Element Analysis (FEA) programs. FEA requires the conversions of CAD descriptions to analysis-suitable formats form which finite element meshes can be developed. The conversion process involves many steps, is tedious and labor intensive, and is the major bottleneck in the engineering design-through-analysis process, accounting for more than 80% of overall analysis time, which remains an enormous impediment to the efficiency of the overall engineering product development cycle.

The approach taken in [1] was given the pithy name *Isogeometric Analysis*. Since its inception it has become a focus of research within both the fields of FEA and CAD and is rapidly becoming a mainstream analysis methodology and a touchstone for geometric design [2]. The key concept utilized in the technical approach is the development of a new paradigm for FEA, based on rich geometric descriptions originating in CAD, resulting in a single geometric model that serves as a basis for both design and analysis.

In this talk I will describe areas in which progress has been made in developing improved Computational Mechanics methodologies to efficiently solve vexing problems that have been at the very least difficult, if not impossible, within traditional FEA. I will also describe current areas of intense activity and areas where problems remain open, representing both challenges and opportunities for future research (see, e.g., [3]).

Key Words: *Computational Mechanics, Computer Aided Design, Finite Element Analysis, Computer Aided Engineering*

REFERENCES

[1] 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.

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

[3] *Isogeometric Analysis Special Issue* (eds. T.J.R. Hughes, J.T. Oden and M. Papadrakakis), Computer Methods in Applied Mechanics and Engineering, 284, (1 February 2015), 1-1182.

Thomas J.R. Hughes

Peter O'Donnell Jr. Chair in Computational and Applied Mathematics
Professor of Aerospace Engineering and Engineering Mechanics

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 in 2002.

He is an elected 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, Northwestern, and A Coruña.

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, the Computational Mechanics Award of the Japanese Association for Computational Mechanics, the Humboldt Research Award for Senior Scientists from the Alexander von Humboldt Foundation, the AMCA Award for an International Scientific Career from the Argentinian Association for Computational Mechanics, and the Wilhem Exner Medal from the Austrian Association for SME (Österreichischer Gewerbeverein, OGV). He has received ASCE's highest honor, election to Distinguished Member.

The Special Achievement Award for Young Investigators in Applied Mechanics is an award given annually by the Applied Mechanics Division of ASME. In 2008 this award was renamed the *Thomas J.R. Hughes Young Investigator Award*.

In 2012 the Computational Fluid Mechanics Award of the United States Association for Computational Mechanics was renamed the *Thomas J.R. Hughes Medal*.