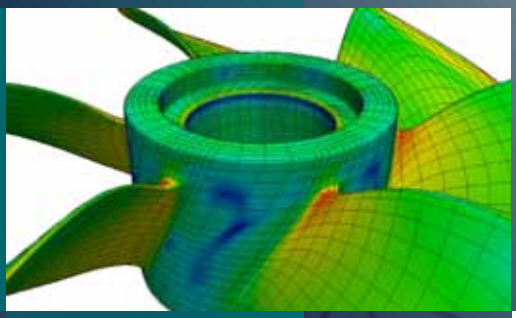
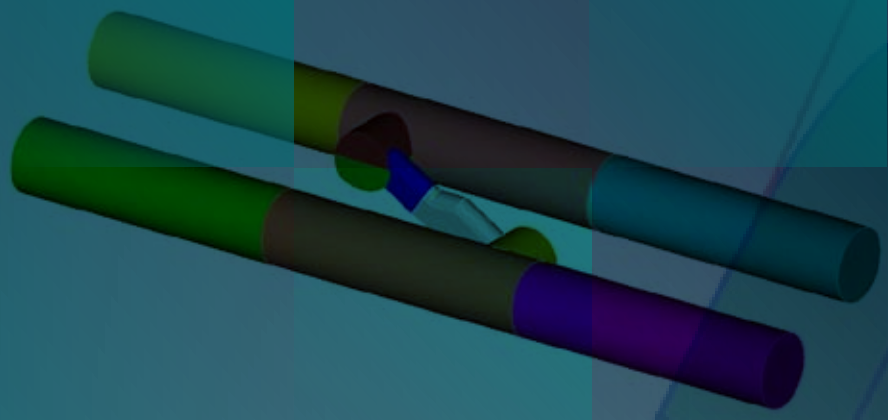
Iso-geometric methods for numerical simulation

CISM, Udine, Italy
May 20 – 24, 2013
Advanced school
coordinated by
Gernot Beer and
Stephane P.A. Bordas





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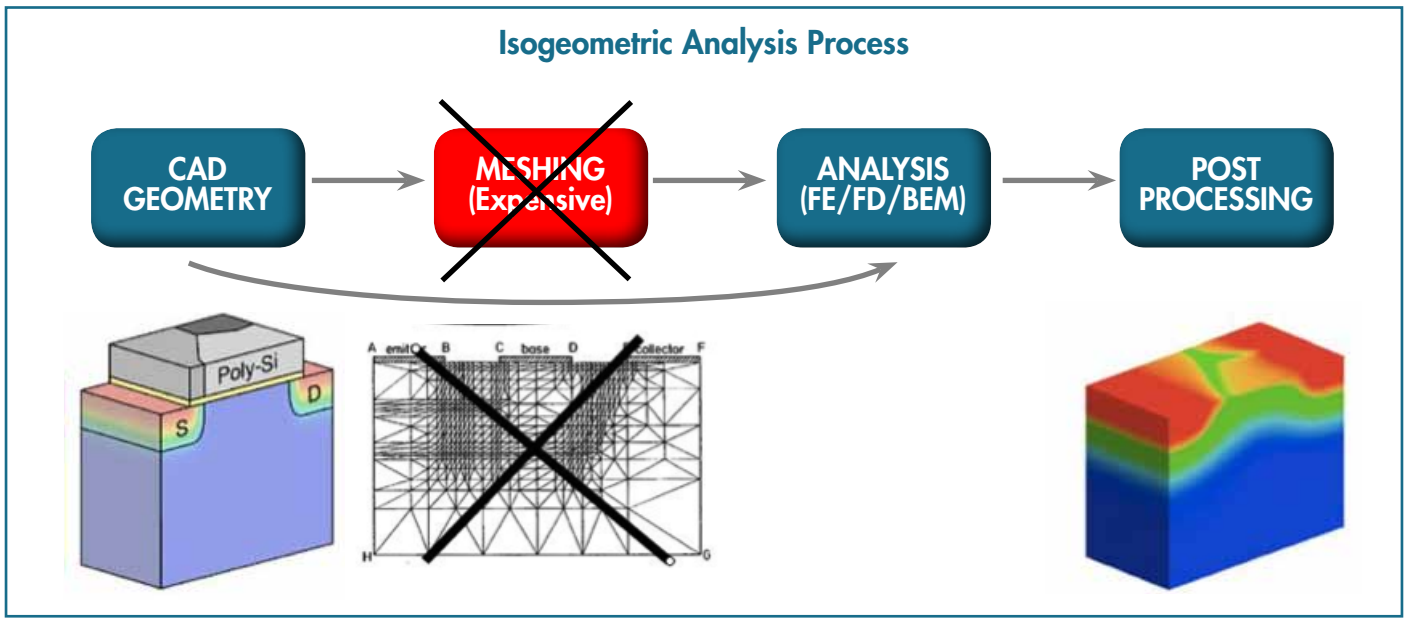
COURSE OUTLINE AND OBJECTIVES

Since the first initiative by Prof. Hughes, followed by the publication of an excellent book by T.J.R. Hughes, J.A. Cottrell and Y. Bazilevs, iso-geometric analysis has become very popular. The main motivation was to tie Computer Aided Design (CAD) and finite element analysis more closely together. Non-uniform Rational B-splines (NURBS), that are used by CAD programs, allow a much more accurate description of a complex surface geometry with reduced input data, than the Serendipity shape functions usually used by Finite Element (FEM) and Boundary Element (BEM) software.



More recently T-Splines have been introduced, that allow the description of complex surfaces with even less data. The term "iso-" is used to indicate that the same functions, that are used to describe the geometry of the problem, are also used for describing the variation of the unknown. Recently the idea of a "super-geometric" approach was proposed, where different functions are used for the description of the unknown, as this may me advantageous in some applications.

In recent years it has been shown that iso-geometric methods have significant advantages over conventional methods. One advantage is an improvement in the quality of the results with fewer unknowns, the other is that it is possible to avoid mesh generation by using the geometrical information from a CAD program directly in the analysis.

The aim of the school is to present the state of the art in iso-geometric modelling and to show how the method has advantages over existing methods. The unique feature of the proposed course is that the implementation in both the FEM and BEM will be discussed. First an (method agnostic) introduction to geometric modelling with NURBS and T-Splines will be presented. Next the implementation will be discussed.

PROPOSED LECTURE TOPICS

- From B-splines to NURBS
- T-Splines
- Iso-geometric analysis, basics
- Enriched iso-geometric FEM analysis
- Isogeometric computational fluid dynamics and fluid structure interaction.
- Iso- and super-geometric Boundary Element Method (BEM)

After the course participants will have a basic knowledge of iso-geometric modelling and understand the subtle differences with respect to conventional methods. Participants will have seen - on practical examples - the advantages of the method. Some numerical examples with the open-source software GeoPDEs and CMOS http://arxiv.org/pdf/1205.2129 will be presented.

The course is a must for all that want to be up to date with the latest trend in numerical simulation and a unique opportunity to learn about this exciting method from eminent speakers, who were in the forefront of its development.

SPEAKERS

Gernot Beer (coordinator),
emeritus Professor, Institute for Structural Analysis, Graz University of Technology, Austria
and conjoint Professor, Priority Research Centre for Geotechnical and Materials Modelling
University of Newcastle, Australia

Stéphane P.A. Bordas (co-coordinator),
Professor and Director, Institute of Mechanics & Advanced Materials (IMAM)
School of Engineering, Cardiff University, UK.

Bert Jüttler
Professor, Institute of Applied Geometry, Johannes Kepler University, Austria

Alessandro Reali, PhD, MSc
Department of Civil Engineering and Architecture, Structural Mechanics Division, University of Pavia, Italy

Yuri Bazilevs
Professor, Department of Structural Engineering, University of California, San Diego, USA

Michael A. Scott
Assistant Professor, Civil and Environmental Engineering, Brigham Young University, USA

REGISTRATION

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