

Congress on Numerical Methods in Engineering 29 June - 2 July, 2015, Lisbon, Portugal

Thematic Session: Isogeometric Analysis (IGA)

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Brief description of the theme

On a regular basis, engineering analysis requires stating and solving systems of partial differential equations (PDEs). The most powerful and widely extended techniques for solving PDEs are the so-called Weighted Residuals Methods. To this group belongs, among others, the Finite Element Method (FEM), the Boundary Element Method (BEM), the Finite Volume Method (FVM) and the Mesh-Free Method (MFM), as well as many different formulations included in each of these categories.

With a further step from these formulations, the new Isogeometric Analysis (IGA) methods were originally proposed by Hughes et al. in 2005. At the present moment, and despite their novelty, these methods are already considered to represent a consolidated emerging technology and it is our belief that they really deserve special attention.

The key idea of IGA is using a previously generated CAD model for discretizing both the geometry and the solution to the problem being analyzed. In return for some minor drawbacks, this approach offers a number of major advantages that make the technique specially attractive and promising in comparison with standard formulations.

In particular, the IGA discretization techniques bring more and better compatibility with CAD-generated geometric models. They also incorporate specific automatic mesh-refinement procedures that preserve the geometry of the problem being analyzed (what justifies the name IGA). And finally, what is perhaps the most important issue, they allow for using trial and test functions with an arbitrarily high continuity order, thus making straightforward the treatment of higher order PDEs. Furthermore, implementing IGA into an existing FEM based code is a relatively simple task, which result can be more precise and versatile than the original, but also more efficient (what is surprising) in terms of CPU time and memory storage requirements.

Following the success during CMN2013 Conference (Bilbao, Spain), the second edition of the Isogeometric Analysis (IGA) thematic session is now proposed. The presentations to be considered of special interest for this thematic session are the ones related to the formulation of IGA (from the purely geometrical or analytical to the purely computational aspects), the application of IGA for solving complex problems in Engineering and Applied Sciences, and the use of IGA characteristic discretization techniques (B-Splines, NURBS, T-Splines) in connection with other methods of computational mechanics.