

Advances in Isogeometric Analysis: The Blessing of Regularity

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IsoGeometric Analysis (IGA) is a novel technique for the discretization of partial differential equations. It was introduced by T. Hughes and co-authors in 2005 and since then it has been having a growing impact on several scientific communities, from mechanical engineering, to geometry modelling and numerical analysis. IGA methodologies are designed with the aim of improving the connection between numerical simulation of physical phenomena and the Computer Aided Design systems. This is achieved by using B-Splines or Non Uniform Rational B-Splines (NURBS) for the geometry description as well as for the representation of the unknown fields. Beside the interoperability of CADs and Analysis, the use of Spline or NURBS functions, together with isoparametric concepts, results in an extremely successful idea and paves the way to many new numerical schemes for the discretization of PDEs enjoying features that would be extremely hard to achieve within a standard finite element framework. During this talk, after a short introduction to Isogeometric analysis, I will show how the higher interelement regularity can be exploited to treat incompressibility, to design methods for Reissner-Mindlin plate models and to obtain regular discrete solutions to Maxwell equations. Finally, I will discuss open problems, critical points in the development of IGA, and future research directions.