

PROCEEDINGS

Conforming Embedded Isogeometric Analysis with Applications in Structural Mechanics and Fluid-Solid Interactions

Xuefeng Zhu^{1,*}

¹Dalian University of Technology, Dalian, 116024, China

²Second author's affiliation, Address, City, Postcode, Country

*Corresponding Author: Xuefeng Zhu. Email: xuefeng@dlut.edu.cn

ABSTRACT

Isogeometric Analysis (IGA) was introduced by Thomas Hughes et al. with the aim of integrating CAD and FEA. IGA methods can be categorized into two groups: Conforming IGA, such as T-spline based IGA, and non-conforming IGA, such as immersed or embedded IGA. Embedded or immersed IGA methods do not require the construction of analysis-aware geometry, unlike conforming IGA methods such as T-spline based IGA. However, the Galerkin method does not directly apply to these methods, making it challenging for immersed IGA methods to impose strong Dirichlet boundary conditions directly. Nitsche's method is a popular approach for immersed IGA to implement Dirichlet boundary conditions, but it introduces more complexity and variants.

We propose a Conforming Embedded Isogeometric Analysis (CE-IGA) method that meets the aforementioned criteria. Unlike Nitsche's method and conforming IGA methods, the CAD model is embedded or immersed in a 3D B-spline patch and converted into a B++ spline patch. Then, B++ spline basis functions that satisfy the Kronecker delta function are generated. CE-IGA is a conforming (body-fitted) embedded or immersed method that adheres to the Galerkin method and allows for the direct imposition of strong boundary conditions. The proposed method is applied to structural mechanics and fluid-solid interactive problems. CE-IGA for structural mechanics can handle 3D B-Rep models without the need for reconstructing analysis-suitable geometries. CE-IGA for fluid-solid interactive problems can directly impose Dirichlet boundary conditions without relying on Nitsche's method. Numerical examples of XIGA and FSI validate the efficiency of the presented method.

KEYWORDS

Conforming embedded isogeometric analysis; immersed methods; CE-IGA; B-Rep models

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