A new family of conforming finite elements: the case of Kirchhoff plate model

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ABSTRACT

Non-polar structural models for rods (see [1]), plates, shells (see [2]) and second gradient elasticity can be modeled by means of isogeometric analysis (IGA), that presents high inter element regularity. In [1] was presented an implicit G^1-continuous B-spline multi-patch formulation for the spatial Kirchhoff rods, by means of a change of basis that allows to introduce the end rotations as degrees of freedom.

In this work, we present a conforming formulation for non polar plates based on a rational enrichment of the B-Spline basis as proposed by J. Gregory in 1974 for obtaining G^1-continuous surfaces. In this way conforming quadrilateral elements are obtained also for the case of unstructured mesh cases.

In this contribution we present two plate element of degree $p = 2$ and $p = 3$ that generalize the 16-dof bi-Hermitian interpolation, with 20 degrees of freedom. A generalization of this approach can be obtained by means of knot insertion operation of the IGA. By imposing a weak constraint on the defects on the four corners, the element pass the patch test, present optimal rate of convergence (the elements are free of the C^1-locking as observed in [3]) and present high robustness with respect to mesh distortions.

REFERENCES

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