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Gaussian quadrature rules for univariate splines and their application to tensor-product isogeometric analysis

Michael Barton

Basque Center for Applied Mathematics (BCAM)

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Michael Bartoň*

* Basque Center for Applied Mathematics (BCAM)
Alameda de Mazarredo 14, 48009 Bilbao, Basque Country, Spain
e-mail: mbarton@bcamath.org, web page: http://www.bcamath.org/en/people/mbarton

ABSTRACT

Univariate Gaussian quadrature rules for spline spaces that are frequently used in Galerkin discretizations to build mass and stiffness matrices will be discussed [2]. Their computation is based on the homotopy continuation concept [1] that transforms Gaussian quadrature rules from the so called *source* space to the *target* space. Starting with the classical Gaussian quadrature for polynomials, which is an optimal rule for a discontinuous odd-degree space, and building the source space as a union of such discontinuous elements, we derive rules for target spline spaces with higher continuity across the elements. We demonstrate the concept by computing numerically Gaussian rules for spline spaces of various degrees, particularly those with non-uniform knot vectors and non-uniform knot multiplicities. We also discuss convergence of the spline rules over finite domains to their asymptotic counterparts, that is, the analogues of the half-point rule of Hughes et al.[4], that are exact and Gaussian over the infinite domain. Finally, the application of spline Gaussian rules in the context of isogeometric analysis on subdivision surfaces will be discussed [3], showing the advantages and limitations of the tensor product Gaussian rules.

REFERENCES

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