Fast formation of isogeometric Galerkin matrices by weighted quadrature: basic principles and theoretical aspects

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We present a new algorithm for the formation of matrices stemming from isogeometric Galerkin methods. This algorithm does not employ the element-wise assembling loop which is standard in finite elements codes, and that is inherited by most isogeometric codes. Instead,we loop over the matrix rows and we use a specifically designed weighted quadrature rule for each row. The test function is incorporated in the integration weight while the trial function, the geometry parametrization and the PDEs coefficients form the integrand function. This approach is very effective in reducing the computational cost, while keeping the optimal order of approximation of the method. In this talk we focus on the fundamental ideas and on the theoretical aspects of this promising approach.

References

[1] F. Calabró, G. Sangalli and M. Tani, *Fast formation of isogeometric Galerkin matrices by weighted quadrature*, Comput. Methods Appl. Mech. Engrg. (2016).