Low Rank Solutions to Elliptic Isogeometric Problems

Angelos Mantzaflaris

Radon Institute for Computational and Applied Mathematics
Austrian Academy of Sciences, Altenberger Str. 69, 4040 Linz, Austria
angelos.mantzaflaris@oeaw.ac.at, http://www.angelos-m.info

ABSTRACT

The use of tensor methods in the field of numerical simulation was explored during the last decade, with the aim to overcome the curse of dimensionality, ie. the exponential complexity with respect to the spatial dimension of the computational domain [1]. With the advent of isogeometric analysis during the same period of time, the very same difficulty of dimensionality has appeared with the use with tensor-product NURBS as discretization basis. Indeed, isogeometric simulations are more challenging than in the case of traditional finite element methods. This is due to factors such as the increased degree and the larger supports of the ansatz functions (tensor-product B-splines), that burden the sparsity pattern and bandwidth of the Galerkin matrix. This talk will describe our ongoing work on using tensor methods to accelerate the isogeometric assembly and iterative solution process. The method relies on tensor decomposition of spline functions and integral kernels which arise in the isogeometric Galerkin matrices. This is based on joint works with B. Jüttler, B. Khoromskij and U. Langer [2, 3].

REFERENCES

[1] W. Hackbusch, Tensor spaces and numerical tensor calculus. Springer-Berlin, 2012.

[2] A. Mantzaflaris, B. Jüttler, B. Khoromskij, and U. Langer. Matrix generation in isogeometric analysis by low rank tensor approximation. In *Curves and Surfaces*, volume 9213 of *LNCS*, pages 321–340. Springer, 2015.

[3] A. Mantzaflaris, B. Jüttler, B. Khoromskij, and U. Langer. Low rank tensor methods in Galerkin-based isogeometric analysis. *Computer Methods in Applied Mechanics and Engineering*, 2016 (in press)