Chair for Computation in Engineering
Chair of Computational Modeling and Simulation

Software Lab:

Numerics: ★★★★☆
Mathematics: ★★★☆☆
Programming: ★★★★★

IsoGeometric Collocation Method

Setting

The collocation is a variant of the Finite Element Method (FEM) based on discretization of the strong form. In its basic form, the residual is required to vanish at a specific set of collocation points.

This technique offers attractive features as avoiding numerical integration and producing convenient matrices [1][2]. Nevertheless, it is not widely employed due to limited theoretical results and the smoothness requirements [1][2].

However, the recent approach of IsoGeometric Analysis (IGA) permits to generate solutions with high regularity properties, meeting the collocation prerequisites. Therefore, it is promising to combine these two techniques to produce a highly-efficient and robust method [1][2].

Task

Implement and investigate the IsoGeometric collocation method in the FCMLab [3] software (MATLAB):

- Get familiar with FCMLab.
- Implement IsoGeometric Collocation in 1D and 2D.
- Produce various examples and compare results.

Supervisors

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References

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[3] Zander, N., Bog, T., Elhaddad, M., Espinoza, R., Hu, H., Joly, A., Wu, C., Zerbe, P., Düster, A., Kollmannsberger, S. and Parvizian, J., 2014. FCMLab: a finite cell research toolbox for MATLAB. *Advances in Engineering Software*, *74*, pp.49-63.