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

Software Lab:

PUMLab: Implementation of the Partition of Unity Method in MATLAB

Setting

The Partition of Unity Method (PUM) is a powerful discretization approach well suited for problems featuring internal discontinuities such as material interfaces and cracks. It bases on the idea of enriching the standard finite element basis by special functions that take advantage of a priori knowledge of the solution. This concept is applied in the eXtended and generalized finite element method (XFEM, GFEM). A comprehensive review can be found in e.g. [1,2].
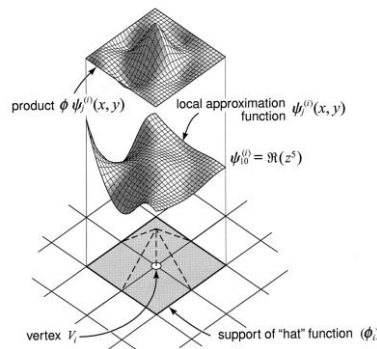

Figure 1: Concept of the Partition of Unity Method [2]

Task

The implementation will be based on FCMLab. The first work steps will include:
1. Getting familiar with PUM and the code structure of FCMLab
2. Extend FCMLab for Lagrange basis functions.
3. Implement and compare different flavors of the PUM.

Supervisors

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References

[1] T.-P. Fries and T. Belytschko, "The extended/generalized finite element method: An overview of the method and its applications," Int. J. Numer. Meth. Engng., vol. 84, no. 3, pp. 253–304, Oct. 2010.

[2] T. Strouboulis, I. Babuška, and K. Copps, "The design and analysis of the Generalized Finite Element Method," Computer Methods in Applied Mechanics and Engineering, vol. 181, no. 1–3, pp. 43–69, Jan. 2000.