Higher order isoparametric unfitted finite element methods

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ABSTRACT

In the recent decade *unfitted finite element methods* have drawn an increasing amount of attention. The possibility to handle complex geometries without the need for complex and time consuming mesh generation is very appealing. The methodology of unfitted finite element methods, i.e. methods which are able to cope with interfaces or boundaries which are not aligned with the grid, has been investigated for different problems. However, The development of numerical methods which are flexible with respect to the geometrical configuration, robust and *higher order accurate* at the same time is still challenging.

One major issue in the design and realization of higher order finite element methods is the problem of accurate and stable numerical integration on level set domains. We present a new approach which allows for a higher order accurate and robust numerical treatment of domains that are prescribed by level set functions [1]. The approach is based on isoparametric mappings that are specifically tailored. Adding together components from isoparametric (fitted) finite element methods and low order (second order) unfitted finite element methods we obtain a method that is robust and fairly simple to implement. The method is geometry-based and can be applied to unfitted interface or boundary value problems as well as to partial differential equations on surfaces.

We apply the method to flow problems on stationary domains [3], give theoretical error bounds and discuss implementational aspects. We further discuss extensions to moving domain problems based on an unfitted space-time discretization [2].

REFERENCES

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