# From STLs to embedded integration meshes via robust polyhedra clipping

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## ABSTRACT

Unfitted finite element methods are useful techniques to simulate problems defined on 3D complex domains. In this context, the conventional approach is to represent the problem geometry using level-set methods. Geometrical data based on level-set functions allow efficient procedures (usually based on marching cubes algorithms) for the generation of integration cells in cut elements. However, real-world engineering applications consider often 3D CAD data for the geometrical definitions. This makes challenging the usage of standard unfitted techniques, since there is not a general and accurate way to translate 3D CAD models into level-set functions.

In this work, we explore a novel technique in order to generate integration grids in cut cells. In contrast to level-set methods, our methodology can be robustly fed from first order CAD models, e.g., STLs. The used approach is based on robust polyhedra clipping [1], exactly capturing non-convex geometries. Moreover, this method is extensible to high order geometries, higher dimensions and parallelizable at large scale.

The technique is implemented in the framework of finite element package Gridap [2] with the AggFEM method [3]. In such implementation, the robustness of the method is demonstrated by successfully handling more than 4k geometries, matching the quality requisites, from the Thingi10K dataset [4].

## REFERENCES

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