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Finite element implementation of fictitious domain method

Meshing of complex computational domains is a difficult problem and the quality of the mesh is directly connected to the quality of the solution. In particular, various method for treating complex boundaries have been proposed such as *Finite cell method*[1] and *CutFEM*[2] in which the computational domain is extended to/embedded into a "simpler" domain, which can be meshed easily. See Figure 1 for an example, where the computational domain (left) is extended to a simple square domain (right). The square domain can be discretized with, for example, regular square elements. The elements that contain the intersection of the original domain needs to be enriched in order to take this into account.

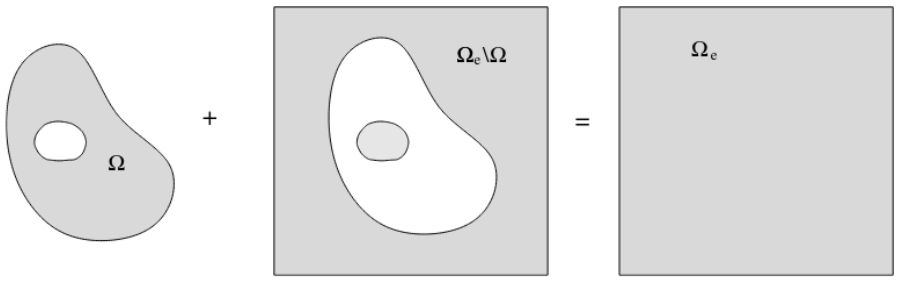

Figure 1: Example of a computational domain Ω extended to a simpler domain Ω_e. Illustration from[1].

The goal of this project is to implement a fictitious domain method in an existing finite element framework, `Ferrite.jl`[a], written in the Julia programming language[b].

References

[1] J. Parvizian, A. Düster, and E. Rank. Finite cell method. *Computational Mechanics* (2007). doi:10.1007/s00466-007-0173-y

[2] E. Burman, S. Claus, P. Hansbo, M.G. Larson, and A. Massing. CutFEM: Discretizing geometry and partial differential equations. *Int. J. Num. Meth. Engng.* (2014). doi:10.1002/nme.4823

[a] https://github.com/Ferrite-FEM/Ferrite.jl
[b] https://julialang.org