Parameter-robust unfitted finite element methods for a Maxwell interface problem

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Geometrically unfitted finite element methods such as CutFEM, Finite Cell, XFEM or unfitted DG methods have been developed and applied successfully in the last decades to a variety of problems, ranging from scalar PDEs on stationary domains to systems of PDEs on moving domains and PDEs on level set surfaces. These approaches combined with established tools of finite element methods allowed to apply and analyse unfitted methods in many fields. In this talk, we deal with an elliptic interface problem for the time-harmonic quasi-magnetostatic Maxwells equations.

Here the material function μ, the magnetic permeability, can jump at an interface. Such problems are considered in low-frequency applications. Standard unfitted Nitsche methods are not robust with respect to the parameter k, proportional to the wavenumber. For example, a standard Nitsche discretization for the curl-curl-operator introduces terms that do no longer vanish for gradient fields. In this talk, we will use a vectorial finite element discretization based on H(Curl) conforming functions. We will tackle the problem of robustness by using a mixed formulation and a Nitsche formulation. Additionally, we apply a careful tailored ghost penalization term.

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