Convergence analysis of finite element methods for $H(curl)$-elliptic interface problems

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In this talk we analyse a finite element method for solving $H(curl)$-elliptic interface problems in general three-dimensional polyhedral domains with smooth material interfaces. The continuous problems are discretized by means of the first family of lowest order Nédélec $H(curl)$-conforming finite elements on a family of tetrahedral meshes which resolve the smooth interface in the sense of sufficient approximation in terms of a parameter δ that quantifies the mismatch between the smooth interface and the triangulation. Optimal error estimates in the $H(curl)$-norm are obtained for the first time. The analysis is based on a so-called δ-strip argument, a new extension theorem for $H^1(curl)$-functions across smooth interfaces, a novel non-standard interface-aware interpolation operator, and a perturbation argument for degrees of freedom for $H(curl)$-conforming finite elements. Numerical tests are presented to verify the theoretical predictions and confirm the optimal order convergence of the numerical solution.

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