# Discussions on Modeling Weak Discontinuities Independent of the Finite Element Mesh

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This paper presents discussions about methods which can be used to model weak discontinuities such as the interface of two materials independent of the finite element mesh. A particular focus is on comparing and contrasting the methods used by the extended finite element method (XFEM) and global-local finite element approximation.

XFEM allows engineering problems involving geometric or material discontinuities to be solved by representing the discontinuity independent of the finite element mesh [1]. The discontinuity is added to the displacement approximation through the partition of unity by the use of an enrichment function, and additional degrees of freedom are added to enriched elements. Sukumar et al. [2] introduced an enrichment function of this form for elements which contain a material interface. Using the global-local finite element approximation [3] allows us to represent the same weak discontinuity by adding additional degrees of freedom, but it does not satisfy the partition of unity.

We discuss the physical interpretation of enrichment using simple 1D (bi-material bar) and 2D (bi-material plate) problems. We show that the local interpolation of global-local finite element approximation yields accurate results, while the enrichment degrees-of-freedom in XFEM require additional constraints in order to represent piecewise linear field within an element that has discontinuity. We discuss the difficulties associated with applying boundary conditions when the enrichment DOFs are located on the boundary.

## References

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