6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

DE-FEM FOR DISCONTINUITY JUNCTIONS

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Key Words: *Enriched FEM, DE-FEM, Junction Enrichment.*

We present a Discontinuity-Enriched Finite Element Method (DE-FEM) [1] for the modeling of arbitrary branched cracks, multi-material domains, and polycrystalline aggregates.

The description of multiple strong and/or weak discontinuities meeting at a point arbitrarily located in an element is made possible thanks to a novel DE-FEM junction enrichment function. The design of this enrichment function and its implementation into a displacement-based finite element package are presented, followed by a discussion of the implementation differences between DE-FEM and other enriched formulations for strong and weak discontinuities (GFEM/XFEM). The performance of DE-FEM is demonstrated through a series of benchmark problems in linear elasticity containing multiple strong and weak discontinuities meeting at junction points. In particular, we analyze the conditioning of the global stiffness matrix to discuss its stability, we perform mesh convergence studies to assess its accuracy, and we apply the method to the anaysis of simple polycrystalline aggregates to illustrate its robustness when dealing with multiple junctions.

REFERENCES

[1] A. Aragón and A. Simone, The Discontinuity-Enriched Finite Element Method. *Int. J. Numer. Meth Eng.*, Vol. **112**, pp. 1589–1613, 2017.