Computational Mathematics Seminar Series

Shape Optimization with Unfitted Finite Element Methods

Jeremy T. Shahan, Louisiana State University

Graduate Student, Department of Mathematics

Digital Media Center 1034
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Abstract:

We present a formulation of a PDE-constrained shape optimization problem that uses an unfitted finite element method (FEM). The geometry is represented (and optimized) using a level set approach and we consider objective functionals that are defined over bulk domains. For a discrete objective functional (i.e. one defined in the unfitted FEM framework), we derive the exact Fr\'echet, shape derivative in terms of perturbing the level set function directly. In other words, no domain velocity is needed. We also show that the derivative is (essentially) the same as the shape derivative at the continuous level, so is rather easy to compute. In other words, one gains the benefits of both the optimize-then-discretize and discretize-then-optimize approaches.

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957