

## The Generalized Finite Element Method

Uday Banerjee  
Department of Mathematics  
Syracuse University

**Abstract:** The Generalized Finite Element Method (GFEM) is a class of flexible Galerkin methods to approximate the solutions of partial differential equations. It allows to incorporate the “features” of the unknown solution into the trial space. This is done locally based on the available information about the unknown solution, which is often incomplete and “fuzzy”. GFEM (in its various forms) has been used extensively in the engineering community to address problems involving cracks, interfaces, and certain micro-structures.

In these talks, we will present a general survey of various aspects of the GFEM in the context of elliptic problems. We will discuss examples of trial spaces tailored to individual problems, together with their approximation properties. We will also address the condition number of the associated stiffness matrix, which can be a major issue in the GFEM. Some open problems in this area will also be highlighted in these lectures.