

Theory and Practice of the Generalized/eXtended Finite Element Method

Short course at the Engineering Mechanics Institute Conference 2016 (EMI 2016)
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Course instructors

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Course abstract and objectives

The Generalized or eXtended Finite Element Method (G/XFEM) has received increased attention and undergone substantial development during the last decade. This method offers unprecedented flexibility in the construction of shape functions and corresponding approximation spaces. With the proper selection of enrichment functions, the G/XFEM is able to address many shortcoming and limitations of the classical FEM while retaining its attractive features.

This short course will introduce participants to the approximation theory of G/XFEM and its formulation for three-dimensional fractures, polycrystalline and fiber-reinforced materials. The implementation of the G/XFEM in an existing FEM software is discussed. Recent developments such as the Stable Generalized FEM (SGFEM) and GFEMs for problems with multiple spatial scales of interest (GFEM^{gl}) are also presented. Representative implementations of the G/XFEM in MATLAB illustrating the performance and practical aspects of the method will be discussed.

Who will benefit from this course?

Doctoral and post-doctoral students, researchers, academics as well as developers from industry.

Tentative Schedule

1. Open remarks and course objectives
2. Introduction to Partition of Unity methods: Motivation, basic ideas and terminology
3. Approximation theory for the GFEM
4. Application: G/XFEM for three-dimensional fractures
5. Application: G/XFEM for polycrystalline and fiber-reinforced materials
6. Recent developments: Bridging scales with G/XFEM and Stable Generalized FEM (SGFEM)s
7. Implementation of the G/XFEM

Course material: Lecture slides, copies of selected references, and one-dimensional MATLAB codes will be provided.

Sponsoring committee: Computational Mechanics Committee.

Length of the course: Full-day course.