Finite Element Analysis (FEA)

Degrees Offered

- Graduate Certificate - FEA Professional

Program Description

The Graduate Certificate - FEA Professional is a fully-online graduate-level certificate program that teaches advanced skills in finite element analysis for structural applications. The program has been designed to train recent graduates or mid-career professionals with at least a BS in engineering, computer science, or applied engineering physics who are interested in careers and/or opportunities in design, product development, or applied research. The program leverages industry-leading software to empower students with the skills and experience to drive innovation in their chosen field. Our courses help students build a foundation of practical knowledge focused on key fundamentals of applied computational mechanics complemented by the perfect balance of theoretical background. The fundamentals learned here may be applicable across a broad range of industries. Upon completion of the program, graduates will have the skills to: (a) earn software-specific endorsements/certifications for industry-leading products such as Abaqus, SolidWorks Simulation, ANSYS; (b) drive innovation through the effective application of simulation tools for ideation and design verification; (c) leverage simulation to reduce physical testing in new product development (NPD) and reduce time to market; (d) exploit parametric simulation, DOE, and optimization to reveal more and better R&D solutions; (e) identify CTQ's in your development or applied research projects and quantify impact on all relevant outcome metrics; (f) execute, review, and manage simulation strategies for your NPD or applied research pipeline; and (g) spec software tools and training for your team.

Program Director and Associate Professor

Anthony J. Petrella

Program Requirements

The Graduate Certificate - FEA Professional requires a set of three core courses (Table 1) and one elective chosen from selected relevant online courses (Table 2). Elective options will continue to expand as the program matures.

The student must complete the following three core courses.

FEGN525	ADVANCED FEA THEORY & PRACTICE	3.0
FEGN526	STATIC AND DYNAMIC APPLICATIONS IN FEA	3.0
FEGN527	NONLINEAR APPLICATIONS IN FEA	3.0

The student must complete one of the following elective courses (3 semester hrs).

FEGN528	FEA FOR ADVANCED DESIGN APPLICATIONS	3.0
AMFG521	DESIGN FOR ADDITIVE MANUFACTURING	3.0

Transfer Credits

Transfer credits are not currently accepted to satisfy requirements for the Graduate Certificate - FEA Professional.

Prerequesites

A baccalaureate degree in engineering, computer science, a physical science, or mathematics is required.

Courses

FEGN525. ADVANCED FEA THEORY & PRACTICE. 3.0 Semester Hrs.
This course examines the theory and practice of finite element analysis. Direct methods of deriving the FEA governing equations are addressed as well as more advanced techniques based on virtual work and variational methods. Common 1D, 2D, and 3D element formulations are derived, and key limitations examined. Matlab is used extensively to build intuition for FEA solution methods and students will create their own 2D FEA code by the end of the course. The commercial FEA software Abaqus is introduced with hands-on examples and Matlab solutions are compared to Abaqus for model validation.

FEGN526. STATIC AND DYNAMIC APPLICATIONS IN FEA. 3.0 Semester Hrs.
This course emphasizes proficiency with commercial FEA software for solution of practical static, quasistatic, and dynamic structural problems. Common 1D, 2D, and 3D elements are examined in the context of linear solution techniques. Students will explore efficient methods for model construction and solution with commercial tools (the Abaqus FEA software). Emphasis will also be placed on verification, validation, and reporting standards for effective application of FEA software tools. Online course. Prerequisite: FEGN525.

FEGN527. NONLINEAR APPLICATIONS IN FEA. 3.0 Semester Hrs.
This course explores common nonlinearities frequently encountered in structural applications of FEA. Students will gain proficiency in modeling geometric nonlinearity (large strains), boundary nonlinearity due to contact, and material nonlinearity (creep, rate dependence, plasticity, temperature effects, residual stress). The commercial FEA software Abaqus is used for hands-on experience. Online course. Prerequisite: FEGN526.

FEGN528. FEA FOR ADVANCED DESIGN APPLICATIONS. 3.0 Semester Hrs.
In this course students will learn the automation tools and methods necessary for effective application of FEA on advanced design problems. Strategies for parametric analysis, performance optimization, and consideration of statistical uncertainty will be examined using Python scripting and commercial automation software. Online course. Prerequisite: FEGN526.