Mechanics, Materials and Computing (MMC)

The MMC education and research area focuses on the scientific understanding and practical application of the emergent complex behavior of materials through computer simulation techniques for the analysis of deformation, flow and failure of natural and engineered materials.

MS Concentration in Mechanics, Materials and Computing

Computational Modeling and Monitoring for Resilient Structural and Material Systems

This concentration provides advanced skills for modeling and monitoring structural system performance. Application areas include:

- Aerospace
- Automotive
- Biomechanical
- Shipbuilding
- Defense
- Energy
- Built Infrastructure, e.g., buildings, pipelines, dams
- Transportation infrastructure
- Consumer goods
- Electronic packaging
- Manufacturing

Courses prepare students for careers in structural engineering consulting and design, software development, materials modeling, and other fields involving knowledge of computation and modeling, materials, and mechanics. Graduates are able to develop and employ mathematical models of complex physical systems related to the above application areas, and to perform computer simulations using these models. They also are able to interpret modeling results and make decisions based on the simulations.
**Recommended Courses**

The following courses are recommended for this concentration, but the MS program is flexible and students should work with their academic advisors to tailor coursework towards their own individual interests and career goals.

**First Semester**

- 12-676 Fundamental Concepts and Methods of Structural Mechanics
- 12-635 Structural Analysis  
  *(if not previously taken)*
- 12-659 Special Topics: Matlab/MathCAD
- 12-734 Structural Health Monitoring
- 24-661 Vibrations

**Second Semester**

- 12-631 Structural Design  
  *(if not previously taken)*
- 12-686 Computational Materials Modeling for Structures
- 12-735 Urban Systems Modeling
- 12-755 Finite Elements in Mechanics

**Additional Courses**

The following crosscutting courses relate to this concentration and may be of interest for additional course work, depending on individual student goals.

- 12-623 Molecular Simulation of Materials
- 12-671 Special Topics: Fundamental Concepts of Computing in CEE
- 12-701 Mathematical Techniques in Engineering
- 12-703 Numerical Methods in Engineering
- 12-704 Probability and Estimation Methods for Engineering Systems
- 12-740 Data Acquisition
- 12-741 Data Management
- 12-742 Data Mining
- 12-772 Inelasticity
- 12-775 Introduction to Solid Mechanics I
- 12-776 Introduction to Solid Mechanics II
- 12-784 Special Topics: Advanced Multiscale Modeling and Computational Engineering Materials
- 15-210 Parallel and Sequential Data Structures and Algorithms

For a full listing of available courses and their descriptions, visit the Course Catalog in the HUB (cmu.edu/hub)