

Syllabus of Course ME-CEE 426-1
Room (TBD)
Tue/Thu – 3:30-4:50pm

Advanced Finite Element Methods I
Mark Fleming
fleming_mark@yahoo.com

DAY/DATE	SUBJECT
	Chapter 1. Introduction
Tue 1/8	Nonlinearity in mechanics
	Chapter 2. Lagrangian and Eulerian finite elements in one dimension
Thu 1/10	Total Lagrangian (2.1 thru 2.5). Solution methods (2.12).
Tue 1/15	Updated Lagrangian (2.6 thru 2.8). Solution methods (2.12). Summary (2.13)
	Chapter 3. Continuum mechanics
Thu 1/17	Deformation and motion (3.1, 3.2). Strain measures (3.3).
Tue 1/22	Stress measures (3.4). Polar decomposition and frame invariance (3.7).
Thu 1/24	Governing equations (3.5). Lagrangian governing equations (3.6).
	Chapter 4. Lagrangian meshes
Tue 1/29	Governing equations (4.1, 4.2). Updated Lagrangian formulation in multi-dimensions (4.3 thru 4.5).
Thu 1/31	Updated Lagrangian: implementation (4.5). Corotational formulations (4.6).
Tue 2/5	Total Lagrangian (4.7). Weak form (4.8). Implementation (4.9).
Thu 2/7	Review session.
Tue 2/12	Midterm
	Chapter 5. Constitutive models
Thu 2/14	Stress-strain curve (5.1, 5.2). 1D elasticity (5.3). Nonlinear elasticity (5.4)
Tue 2/19	Nonlinear elasticity (5.4). 1D plasticity (5.5).
Thu 2/21	Multiaxial plasticity (5.6p). Stress update algorithms (5.9).
Tue 2/26	Continuum mechanics and constitutive models (5.10).
	Chapter 6. Solution methods and stability
Thu 2/28	Explicit methods (6.1, 6.2).
Tue 3/5	Equilibrium solutions and implicit time integration (6.3).
Thu 3/7	Linearization (6.4).
Tue 3/12	Stability and continuation methods (6.5). Numerical stability (6.6).
Thu 3/14	Review session.
Wed 3/20	Final Exam

Prerequisites: CEE 327 or ME 326 or equivalent.

Text Book: Ted Belytschko, Wing Kam Liu, Brian Moran (2014). Nonlinear Finite Elements for Continua and Structures. *John Wiley & Sons, Ltd.* [2014 edition]

Programming: MATLAB projects

Homework: Due 1 week after day assigned. Computer assignments due 2 weeks after day assigned.

Office Hours: Mark Fleming –Th. 2-3:30pm; or by appointment, TA office hours TBD

Grading: Homework 20%. Computer assignments 25%, Midterm 25%, Final 30%