Spring 2003 Special-Topics Course Announcement
ASEN 5519
Finite Element Programming with *Mathematica*

This Special Topics course is a "spinoff" from ASEN 5007, **Introduction to Finite Element Methods** (IFEM). It was last offered in 1997.

Finite Element Programming with Mathematica concentrates on the programming of the Finite Element Method (FEM) for Structural Mechanics using the latest version (4.0) of *Mathematica*.

Who should take this course? Graduate and senior students interested in learning more about FEM and *Mathematica* programming as driven by an application.

What is the difference from ASEN 5007? We will focus on a *general purpose* implementation which can mix different element types in 3D. The IFEM programs are all special purpose: a different program for each different structural type. In addition an implementation of vibration analysis will be discussed.

The ability to use higher order languages such as *Mathematica* and *Matlab* is becoming an important skill sought by industrial employers in today's competitive environment. On the other hand, the ability to program in low-level computer languages such as C or Fortran is becoming less relevant to industry. *Mathematica* and *Matlab* provide "grey boxes" that are of sufficiently high level to avoid unnecessary details, yet visible enough to be modified and customized by users.

COURSE INFORMATION

Instructor:	Carlos A. Felippa
	Department of Aerospace Engineering Sciences
Office/Phone:	ECAE 187, 492-6547
Credit hours:	3
Time/Place:	tentatively TuTh, 2-3:15 pm (see ASEN Spring Schedule of Courses for confirmation), place TBA
Textbook:	notes posted on Web site
Mathematica texts	Wolfram's *The Mathematica Book* (reference only, it's online if you have Mathematica 3.0 or higher).
Prerequisites:	an introductory course in FEM, access to Mathematica 4.0 or higher, access to C or C++ compiler, above average programming ability.
Course work:	Computer homework assignments every two weeks, take-home final exam (grade weights: 65%-35%). No midterm exams.
Web Site	Course material will be posted to the Web site `http://caswww.colorado.edu/courses.d/MIFEM.d/Home.html`

COURSE OUTLINE (tentative, subject to modifications)

1. Introduction to *Mathematica*. Basic aspects of the language, use of functions and modules, replacement rules, graphics. Output to C statements.
2. Complete FEM program examples in *Mathematica* for 2D/3D truss and frame analysis.
3. Programming a linear equation solver for FEM.
4. Programming the assembler for FEM.
5. Programming an element library.
6. Programming the problem definition.
7. Putting the pieces together to solve static problems.
8. Implementing an eigensolver for vibration analysis.
9. (If time allows) Implementing dynamic response by direct time integration.