CE 233 Computational Mechanics

Instructor:

Francisco Armero
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Office hours: To be announced

Location and time:

Online through Zoom, MWF 3-4pm.

Homework:

Homework will be assigned along the course, involving theoretical and programming assignments. We will use FEAP (Finite Element Analysis Program) No late homework will be accepted. Assignments must be developed and submitted individually. Submissions must be one single PDF file for each assignment in the `bcourses` page.

Solution sets, class handouts and different announcements will be posted in my Web home page (http://faculty.ce.berkeley.edu/armero/Courses/CE233).

References:

There is no textbook for the course; handouts will be distributed instead. Three references that cover the material of the course (and beyond) are:

1. Zienkiewicz, O.C. & Taylor, R.L., "The finite element method: volumes 1, 2 and 3", 5th [2000], 6th [2005], 7th [2013] editions (see the description of FEAP in the last chapters).
2. Hughes, T.J.R. [1987], "The finite element method : linear static and dynamic finite element analysis".
3. Bathe, K.J. [1996] "Finite element procedures", edition of 1996 or later.

Grading system:

Grades will be based on the assignments and the final exam. The final exam is planned to be take-home.

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PART I. FINITE ELEMENT METHODS FOR LINEAR PROBLEMS

1. **Fundamentals I – The energy principles of Mechanics:** Weak forms and variational principles.

2. **Fundamentals II – The finite element method:** Properties and implementation of isoparametric finite elements.

3. **Constrained problems:** Formulation and numerical issues (locking).

4. **Original locking-free finite element methods:** Formulation and implementation of assumed strain and assumed stress methods.

5. **Mixed finite element methods:** Formulation, implementation, and analysis.

6. **Incompatible modes and the enhanced strain formulation.**

PART II. NONLINEAR PROBLEMS.

7. **Nonlinear problems in solid mechanics:** Material and geometric nonlinearities.

8. **Solution techniques for nonlinear equations:** Newton-Raphson scheme.

9. **Finite deformation problems:** Finite elasticity.

10. **Other topics** (depending on time and interests).