

## CE 233 Computational Mechanics

### **Instructor:**

Francisco Armero  
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Office hours: To be announced

### **Location and time:**

544 Davis, MWF 11-noon.

### **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 admitted. Assignments must be developed and submitted individually.

Solution sets, class handouts and different announcements will be posted in my Web home page (<http://www.ce.berkeley.edu/~armero>).

### **References:**

There is no textbook for the course; handouts will be distributed instead. I have put on reserve in the Engineering library (one day check out) three important references that cover the material of the course (and beyond):

1. Zienkiewicz, O.C. & Taylor, R.L., "The finite element method: volumes 1, 2 and 3", 5th edition [2000], 6th edition [2005] (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 will be take-home.

( $\approx$ ) Homework 55%, final 45%.

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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).