

ASEN 5007 Introduction to Finite Element Methods

Homework Assignment #1 (Chapters 2–3)

Due Thursday September 3, 2009 (September 10 for CAETE students)

Please attach this sheet as cover to your HW

Groups return only one HW, with everybody's name on the cover

Do four Exercises:

2.3

2.7

3.6

3.7

Ratings: 15,15,25,20 (For an explanation of exercise difficulty ratings, which determine grading weights, click on Preface Index on the course home page on web, then on Preface.)

For homework presentation guidelines see the back of this HW. Guidelines are also posted on the web site.

Exercise 2.3 is a “refresher” in matrix algebra. Begin by casting the two relations (2.10) in matrix form, then *go matrix all the way* (writing the final results in scalar form and then converting to matrix gets no credit).

Exercise 2.7 illustrates the method by which general displacement-assumed finite elements are actually derived from a variational principle. As this point this is just a recipe. This technique is elaborated upon in Part II of the course.

Labor saving hint for 3.7: the master stiffness matrix \mathbf{K} is the same as that of Exercise 3.6. It is permissible to assume this fact to save time. The displacement solutions, however, will be different.

If you are rusty in matrix algebra, please read Appendices A and B of the Notes. These are posted on the course Web site.

ASEN 5007: Introduction to FEM - Homework Preparation Guidelines - Fall 2009

Homework Assignment and Solution Posting:

- Homework Exercises are normally chosen from those listed at the end of the Note Chapters. HW assignments are numbered 1 through 12, and are posted on the web site with their due dates. Each assignment usually spans two Chapters (sometimes one, occasionally three). Solutions are posted on the web once all HW, including those from CAETE students, have been received by the due date.
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Guidelines for Grading:

- Group homework is encouraged. See rules in course outline handout.
 - HW are due at the beginning of the class on the due date.* If you will be absent that day, please make appropriate arrangements. LATE HOMEWORKS WILL NOT BE GRADED AND ARE NOT ACCEPTED FOR CREDIT.**
 - The grading weight of each Exercise is given in the Notes. Sometimes optional problems are assigned; if so they are given the same weight. The aggregate scores for each assignment are converted to percentages. For example, if three Exercises of weights 10, 15 and 15 are assigned and the scores are 8/10, 7/15 and 15/15, the overall score is $30/40=75\%$.
 - Lowest HW grade will be dropped when computing the overall HW average.
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Guidelines for Presentation:

- **Restate the homework question.** This is to make sure you are solving the correct exercise and that you understand what is being asked. It is not uncommon to solve the wrong problem, or for the wrong variables. If the question is long, including perhaps figures and/or computer code, a summary paragraph is OK.
- **Neatness counts:** normally 25% of the homework grade for each exercise is based on presentation, whereas the remainder is based on the technical content and correctness.
- Write only on *one side* of the paper. Use of engineering paper is strongly recommended.
- Be sure to start each EXERCISE on a NEW page to facilitate grading
- Show work: just giving the final answers gets no credit.
- In the presentation of the technical work, keep a narrative of what you are doing, *as if writing a technical paper*. Identify the equations you use and their sources. Odds are that you did not come up with the equations you are using on your own. Where did you get them? Generally a equation number from the Notes will do. If it has a name (for example: Hooke's law) that will also do.
- *Highlight* answers by boxing or underscoring, and mark with arrow on margin.
- If the problem specifies physical units, be sure to identify them in the answers.
- When making plots of your results use graph paper or engineering paper, or do them with some computer program. Use of personal computers for calculations in non-computer HW is encouraged (see next bullet). Hand plots should be drawn using a straight edge and french curve or compass.
- If you use *Mathematica* or similar program (such as MathCAD or Matlab symbolic toolbox) to do a *non-computer exercise*, please include the cell with the results (including graphics if necessary) and attach to the homework. Inclusion of the source cell(s) (a.k.a. script) is optional.
- For exercises *requiring computer work*, please follow the guidelines in the statement of the problem. Usually the source code or part of it is required, as well as the cell or file that contains the results.
- Be sure to *write your name* on the HW assignment cover sheet, or names if done by a group, and your initial(s) on subsequent pages. Staple pages securely. If returned by a group, *underline or mark with an arrow* the name of the student that will pick it upon grading. On-campus HWs not claimed during class may be picked up from the instructors office at ECAE 187. Graded HWs of CAETE students are mailed back by the CAETE office.

* CAETE students are subject to special rules as regards due dates. See postings for details.

** This strict policy is a consequence of group HW being required. If you feel you may miss HW deadlines because of overwork, join a group of hard workers and pool your efforts.