

---

## **Finite Element Analysis**

ME 478

University of Washington, Seattle

Spring Quarter 2015

---

---

**Location:** Denny 305 (Lecture) **Time:** M-W 10:30-11:20am  
Mary Gates 030 (Computer Lab) F 10:30-11:20am

**Instructor:** Prof. Nathan J. Sniadecki **e-mail:** nsniadec@uw.edu  
MEB 318

**TA:** Kevin Beussman **email:** beussk@uw.edu

**Website:** <http://courses.washington.edu/nsniadec/ME478/S15>

**Description:** This course is an introduction to finite element analysis. The basic mathematical theory of finite element analysis will be introduced throughout the quarter. The course will also introduce you to a commercial finite element packages through several design projects in the area of linear solid mechanics, thermal analysis, and vibration analysis. At the end of the quarter you should be familiar with the theory and capable of designing and analyzing structures using finite element analysis. Lecture and Computer Recitations.

**Prerequisites:** M E 123 – CAD  
M E 374 – Systems Dynamic Analysis and Design  
MATH 308 – Matrix Algebra with Applications  
(or) AMATH 352 – Applied Linear Algebra

**Required Text:**

[1] Logan, *A First Course in the Finite Element Method, 5<sup>th</sup> Edition*, Cengage Learning)

**Recommended Texts:**

[2] Hibbeler, R.C., *Mechanics of Materials*, Pearson/Prentice Hall, Upper Saddle Ridge, NJ

**Grading:**

1) Homework	20%
2) Computer Labs	15%
3) Projects	30%
4) Midterm Exam	15%
5) Final Exam	20%

**Course Policies:**

*Academic Misconduct:* Cheating or plagiarism is academic misconduct. Violation of the College of Engineering's policy will be reported (<http://www.engr.washington.edu/mycoe/am/ampolicy.html>).

*Homework Policy:* All assignments must be handed in to the Professor at the start of class on the due date. Do not drop it off anywhere else. If you used MATLAB or other software to complete your homework, print out the code you wrote to solve the problem and your results. We require that you circle your answers on the print-outs. Late homework will not be accepted.

*Lab Policy:* There will be computer lab sessions for this course where you will run guided tutorials with the TA(s). After completing the tutorial, you are required to show the TA your final work to receive full credit before you leave the computer lab. You will not receive credit for the week's session if you do not show your completed work to the TA. If you are not able to complete the lab in the time period for the class, please make arrangements with the TAs to turn in the completed lab via email. If you are absent from a lab sessions, you will not be able to make up the work. You may make up a lab session only if you notify Prof. Sniadecki and the TA at least 48 hours in advance.

*Project Report Policy:* This course has projects that require you to run commercial FEA software and write a report on the results. Late reports will not be accepted. All reports are to be printed and handed in before class starts on the due date.

*Collaboration Policy:* You may discuss projects and homework with your fellow students, and even collaborate on the solution, but you must list on the report or homework the name of the person(s) that collaborated with you on the effort. You may not copy someone else's code, homework, reports, data, or figures.

*Exam Policy:* All exams must be completed on the specified date. Only under proven, extraordinary circumstances will a makeup exam be permitted.

*Classroom Policy:* Please consider the learning mission of the course and refrain from activity that is disruptive during lectures or computer lab sessions.

**Course Outcomes and Assessment:**

By the end of this course, the student will be able to:

1. Derive the element stiffness matrices for truss, beam and simple planar elements
2. Understand the advantages/disadvantages of different discretization techniques
3. Able to apply appropriate constraints and boundary conditions to finite element models
4. Use the commercial FEA code, e.g. ANSYS, to solve linear static solid and structural mechanics problems

**Contribution of Course to Professional Development:**

The aim of the course is to prepare students for engineering practices by familiarizing them with finite element analysis and computational packages, advancing their fundamental engineering knowledge, and developing their technical communication abilities.

## Project Report Requirements:

The reports you submit for the projects in this class are to be in the form of a report. The following sections are required in the report: abstract, introduction, procedure, results, discussion, and conclusions. The reports will be graded out of 100 points and based upon the grading items in Table 1.

**Table 1. Report Grading Points**

Item	Points
Overall grammar, spelling, and punctuation	10
<b>Abstract:</b>	
Briefly describe what was done, why it was done, and what the findings were. The most important point should be made in the first sentence of the abstract.	5
<b>Introduction:</b>	
Provide a brief background of the problem and the purpose for the FEA model.	5
<b>Procedure:</b>	
Indicate the type of elements used, material properties, boundary conditions and applied loads, and how the model was meshed (number of nodes, node seeding if any, etc.). Include a computer drawn figure of your model with dimensions. DO NOT show figures with black backgrounds (convert them to a white background using the instructions below)	20
<b>Results (and Appendices):</b>	
Analysis of the modeling data is complete, clear, and correct.	15
Results in figures, graphs, and tables are accurate and important features are described in the text.	20
Format of graphs and tables is professional looking. Appropriate units are indicated. Captions to describe the contents of the graph or table. References to graphs, tables, and appendices are made in the text of the report.	10
<b>Discussion:</b>	
Describe your engineering insight on the results of the model and explain any errors or differences between model and theory	10
<b>Conclusions:</b>	
Summarize the modeling results and give recommendations based upon your findings.	5

## Tips for ANSYS Graphics:

Do not to use the print screen feature on your laptop to make an image of your ANSYS results. Instead, you can use:

PlotCtrls > Capture Image

A new image window will pop up of your model. To save the image shown in the window, go to:

File > Save As

The menu that opens will let you save your image as a BITMAP to the remote drive (Documents). Then, you will need to use Skydrive, Dropbox, Google Drive, Box, FTP, or UWCatalyst's File Manager to move your file over to your laptop. These are extra steps than using print screen, but the quality should be much better.

To switch the background from black to white:

PlotCtrls > Style > Colors > Reverse Video

This feature is very helpful for making a nice looking report without a black background in the figure.