

Eng M 918 – Homework 2 – Spring 2009

Purpose:

- Evaluating elements of documentation and report submission
- Development of isoparametric elements
- Assembling from elements and introducing boundary conditions
- Checking the solution
- Comparisons of h and p methods for solving problems

Problem submission:

- All problems will be electronically submitted
 - Your contribution to the results will be clearly identified and credit provided for any work done by others, references provided for published work. etc
 - Each problem will include the code used to solve the problem (in the appendix/attachment)
 - Each program will be properly documented, including
 - Program name and description
 - Original author and date
 - Modifications: authors, dates, and description
 - Notation for (main) variables and all input/output variables
 - Any additional comments (method descriptions, variables, etc)
 - Each problem report will include most of the following
 - Problem description
 - Description of solution process
 - Information to find the code (do not put code in problem solution if not needed to explain your work)
 - Tests done to verify the code
 - Results presented in graphs/pictures/tables
 - Convergence and error analysis
 - Summary and evaluation of results
 - References (if not included as links or footnote in text)
 - Appendices and attachments of related material
1. This problem is focused on your evaluation of your submission. Use a scale from 0-10 to evaluate your submission for homework one (0 = did not include, 10 = completely completed). In doing so provide a grade separately for each of the following:
- a. Evaluate your submission for each of the above stated “Problem submission” conditions both for the major and minor items
 - b. Evaluate your report separately for
 - i. Clarity of problem statements
 - ii. Conciseness of descriptions of solutions
 - iii. Use of plots in place of tables to express results

- iv. Use of lists and subsists and other organizational tools
 - v. Use of properly scaled analysis as opposed to solution numbers (e.g., 10% error as opposed to the number you obtained)
 - vi. Specification of error measure (e.g., Solution shows 10% error compared to exact solution)
 - vii. Rounding to meaningful numbers when appropriate (e.g., 1.00E-3 as opposed to 0.9999999945E-3)
 - viii. Avoiding code and appendix type materials in report
 - ix. Inclusion of all needed results in the appendix
 - x. Completion of all stated questions
 - xi. Conciseness and effectiveness of entire report to clearly show your work
2. Modify the attached one-dimensional steady-state heat conduction application to study the h-type and p-type finite element formulations.
- a. Correct and extend the program to do multi-node elements
 - b. Evaluate your program against exact solutions
 - c. Study the convergence characteristics of h-type and p-type finite element methods
 - d. Extend the program to use a convection boundary condition at the right hand side
 - e. Study the characteristics of the problem for sinusoidal and exponential heat generation