

HW 11: Due 5/10/04
“Review” Problems

1. Express the transient heat conduction equations in (first-order) canonical form; i.e. what is u_i , Γ_{ij} , and F_i .
2. Consider the following ODE

$$\frac{d^2u}{dx^2} + x = 0 \quad x \in (0, 1)$$

with boundary conditions $u(0) = 1$ and $\frac{du}{dx}(1) = 0$. If you are to solve this problem using a 1 element mesh, would a 3-node element give you an exact answer?

3. What set of equations would you need to solve if you had a linear elastic stress analysis problem. Write them in weak form.
4. In class, to compute the torque on an object in a static magnetic field, we performed a surface integral of the tractions arising from the Maxwell stress tensor $t_i = T_{ij}n_j = \frac{1}{\mu_o}[B_iB_j - \frac{1}{2}(B_kB_k)\delta_{ij}]n_j$. Devise an alternative procedure using the magnetic field energy density $W_m = \frac{1}{2}B_iH_i$.
5. Write a MATLAB program to solve Problem 2 using five 3-node elements. Do not use FEMLAB; you are to write your own mini FEA program.