Computational Methods in Structural Dynamics, Final Winter 2000

One 8.5" by 11" cheat sheet.

1. The partially non-dimensionalized equation of motion of a tapered beam is given by: $\frac{\partial^2}{\partial \xi^2}\left(\frac{2}{3}\xi^3 \frac{\partial^2 w}{\partial \xi^2}\right) + 2\xi \frac{\partial^2 w}{\partial t^2} = 0$. Assuming a deflection form of $W(\xi) = a_1 \sin(\pi \xi) + a_2 \sin(2\pi\xi)$, estimate the first and second natural frequencies and mode shapes of the beam using both one and two term representations of the mode shape/s *using the collocation method.*

2. An system is defined by the operator $L = EI\frac{\partial^4}{\partial x^4} + \beta\frac{\partial^3}{\partial x^3}$ with the boundary conditions $x(0) = 0$, $\left.\frac{\partial^2 w}{\partial x^2}\right|_{x=0} = 0$, $x(l) = 0$, $\left.\frac{\partial^2 w}{\partial x^2}\right|_{x=l} = 0$.

   - Is the system self adjoint?
   - If so, is the system positive definite?

3. Apply Cholesky decomposition to the following matrix:

$$\begin{bmatrix} 4 & 1 & 0 \\ 1 & 9 & 2 \\ 0 & 2 & 16 \end{bmatrix}$$

4. A beam/rod deforms in bending (v) and extension (u) and has a mass connected at its end by a rigid bar as shown. Assuming A, I, E, and ρ are constant, derive the equations of motion and the accosiated boundary conditions.