TOBB EKONOMİ VE TEKNOLOJİ ÜNİVERSİTESİ

MAK506 THEORY OF ELASTICITY
FALL 2010
Due date:11.10.2010
HOMEWORK 2

1. (Pr. 2.21, Continuum Mechanics for Engineers, G. Thomas Mase and George E. Mase) For the matrix representation of tensor B shown below,

$$\left[B_{ij}\right] = \begin{bmatrix} 17 & 0 & 0 \\ 0 & -23 & 28 \\ 0 & 28 & 10 \end{bmatrix}$$

   Determine the principal values (eigenvalues) and the principal directions (eigenvectors) of the tensor

2. (Pr. 2.23, Continuum Mechanics for Engineers, G. Thomas Mase and George E. Mase) Determine the principal values of the matrix

$$\left[K_{ij}\right] = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 11 & -\sqrt{3} \\ 0 & -\sqrt{3} & 9 \end{bmatrix}$$

   and show that the principal axes $Ox_1^*x_2^*x_3^*$ are obtained from $Ox_1x_2x_3$ by a rotation of 60° about the x_1 axis.

3. (Pr. 2.24, Continuum Mechanics for Engineers, G. Thomas Mase and George E. Mase) Determine the principal values $\lambda_{(q)}$ $(q = 1, 2, 3)$ and principal directions $\hat{n}^{(q)}$ $(q = 1, 2, 3)$ for the symmetric matrix

$$\left[T_{ij}\right] = \frac{1}{2}\begin{bmatrix} 3 & -1/\sqrt{2} & 1/\sqrt{2} \\ -1/\sqrt{2} & 9/2 & 3/2 \\ 1/\sqrt{2} & 3/2 & 9/2 \end{bmatrix}$$

4. (Pr. 2-8, Elasticity-Tensor, Dyadic, and Engineering Approaches, P.C.Chou, N.J.Pagano)

   Given the following system of strains,

   $\varepsilon_x = 5 + x^2 + y^2 + x^4 + y^4$

   $\varepsilon_y = 6 + 3x^2 + 3y^2 + x^4 + y^4$

   $\gamma_{xy} = 10 + 4xy(x^2 + y^2 + 2)$

   $\varepsilon_z = \gamma_{xz} = \gamma_{yz} = 0$

   Determine if the system of strains is possible. If this strain distribution is possible, find the displacement components in terms of x and y, assuming that the displacement and rotation at the origin are zero.