6.730 PHYSICS FOR SOLID STATE APPLICATIONS

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PROBLEM SET 3

Issued: 2-17-99 Due: 2-24-99, at the beginning of class.

Readings:
PSSA Chapter 4
PSSA Chapter 5

Problem 3.1 *Two-dimensional elastic continuum* **PSSA Problem 4.5**

This problem helps you review the arguments that were done in class and extend them to a different dimension.
Hint: $\mathbf{T} = \lambda e \mathbf{I} + 2\mu \mathbf{E}$.

Problem 3.2 *Former Quiz Problem*
An isotropic elastic material is characterized by the two Lamé constants μ and λ. This elastic solid is a cube and is put under hydrostatic stress; that is, $T_{11} = T_{22} = T_{33} = T$ and $T_{12} = T_{13} = T_{23} = 0$.

(a) Find the **strain** E_{ij} and the **volume contraction** e. Express your answers in terms of T, λ and μ.

(b) Suppose the material now has cubic rather than isotropic symmetry so that it is characterized by the stiffness matrix,

$$\mathbf{C} = \begin{pmatrix} C_{11} & C_{12} & C_{12} & 0 & 0 & 0 \\ C_{12} & C_{11} & C_{12} & 0 & 0 & 0 \\ C_{12} & C_{12} & C_{11} & 0 & 0 & 0 \\ 0 & 0 & 0 & C_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & C_{44} & 00 \\ 0 & 0 & 0 & 0 & 0 & C_{44} \end{pmatrix}$$

Under the conditions of hydrostatic pressure, find the **strain** and the **volume contraction**. Express your answer in terms of T, C_{11}, C_{12} and C_{44}.

Problem 3.3 *Lattice Mismatched Epitaxy* **PSSA Problem 4.8**
A nice application.

Problem 3.4 *Reciprocal Lattice* **SSS Exercises: 2.9, 2.10, and 2.11.** Answer the questions and submit a simple sketch.