27-750 Advanced Characterization and Microstructural Analysis
Solution Set as of 12 Feb '16

A.D. Rollett: last revised on Feb. 12th, 2016.

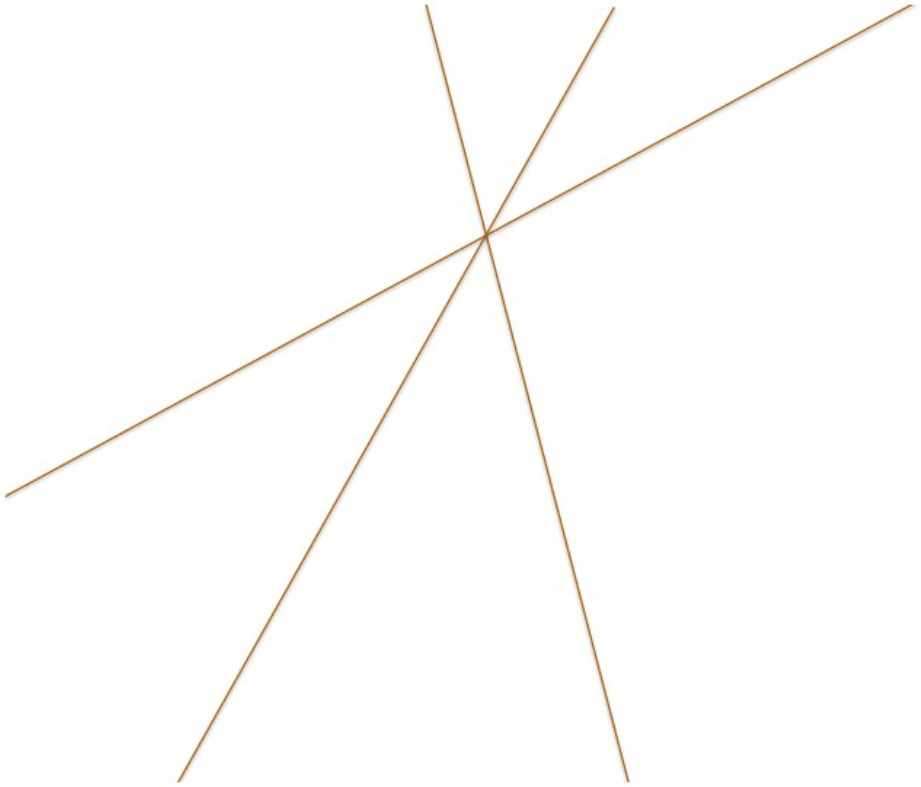
Homework 5; multiple topics.

Due: 11:59 p.m., Weds, Feb. 17th.

Question 1. Write an abstract that describes your project for this class. It must address some aspect of texture (which can be orientation texture or interface texture), or anisotropy of material properties (elastic, plastic, electrical, magnetic, photochemical …), or materials characterization (3D techniques are particularly encouraged). The minimum number of words is 300 and the maximum is 500. One figure is the maximum (but not required).

Question 2. Explain in your own words (so do not, e.g., copy from a wiki page) what simulated annealing is. Your description should include the concepts of the *energy landscape*, an *equation* to explain what is done in each step, and some idea of the challenges associated with finding a *global minimum*. The reason for the question is that this technique is commonly used in many areas despite its simplicity and apparent lack of sophistication. In particular, it is an essential component of the HEDM method, in computational thermodynamics (Calphad) and in so-called Monte Carlo grain growth simulation.

Question 3.
a) Use Matlab to construct your own Hough transform of the figure shown below (also available as a JPG on Box). The expected result, obviously, is that you will obtain the same set of three butterfly pattern described in the notes. To accomplish this will require following the procedure shown in the link below rather carefully. Hint: I had to expand the angle axis in the recommended plot in order to obtain a reasonable aspect ratio (presumably because the image is large in pixels).
http://www.mathworks.com/help/images/ref/hough.html



b) Read the paper by Hart provided (also on Box) and report on what equation is used to transfer intensity from each point in a measured (or synthesized) image to the accumulator diagram in the Hough transform.

c) Show how to read off the angles between the lines from the Hough transform.