Homework 4
289A Statistical mechanics of crystalline solids
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Question 1: Determine the dynamical matrix for a honeycomb crystal assuming only nearest neighbor spring constants. As force constants, use your results from homework 2. If possible, leave the dynamical matrix in parametric form (i.e. in terms of the independent coefficients of the force constants).

Question 2: Determine the reciprocal lattice for a honeycomb crystal. Construct the Brillouin zone and trace out high symmetry directions in the Brillouin zone.

Question 3: This time the dynamical matrix has dimensions 4x4, so you will need to determine the eigenvalues numerically. The vibrational frequencies are the square root of these eigenvalues. Plot the dispersion curves along high symmetry directions for a particular set of numerical values for the force constants.

Question 4: Pick a non-zero k-point in the Brillouin zone (e.g. a high symmetry point) and on an ideal honeycomb grid, plot the displacement field corresponding to the different eigenvectors at that k-point.