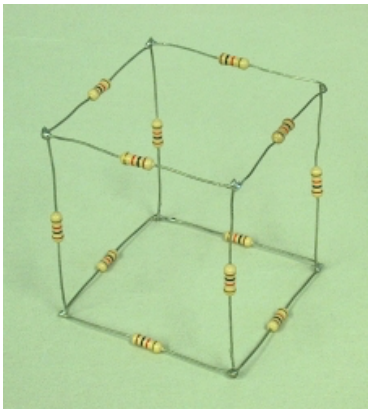
Physics Assignment 4

PHY410: Do problems 1-3
PHY 505: Do all four problems.

Accept the assignment from github classroom: https://classroom.github.com/a/Ylq67DRO. You will then get a link to your own github area.
You should submit your code through github classroom. Submit your writeup, and a link to your github classroom area where your code is, on UBLearns.

Problem 1 : Resistor cube

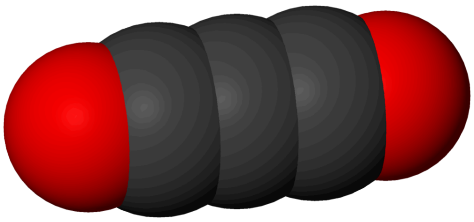


Write a program to solve for the currents in a resistor cube. There are 12 resistors, one along each edge. A voltage source is connected across a body diagonal of the cube.

Find the equivalent resistance for the symmetric case when all the resistors have the same resistance, say 1 Ohm. You might remember this problem from freshman E&M.

Vary the resistance of one resistor at a time. There are 12 resistors in total. How many unique cases are there? Plot the equivalent resistance as a function of the resistance of one resistor for all of the unique cases.

Problem 2 : Carbon suboxide

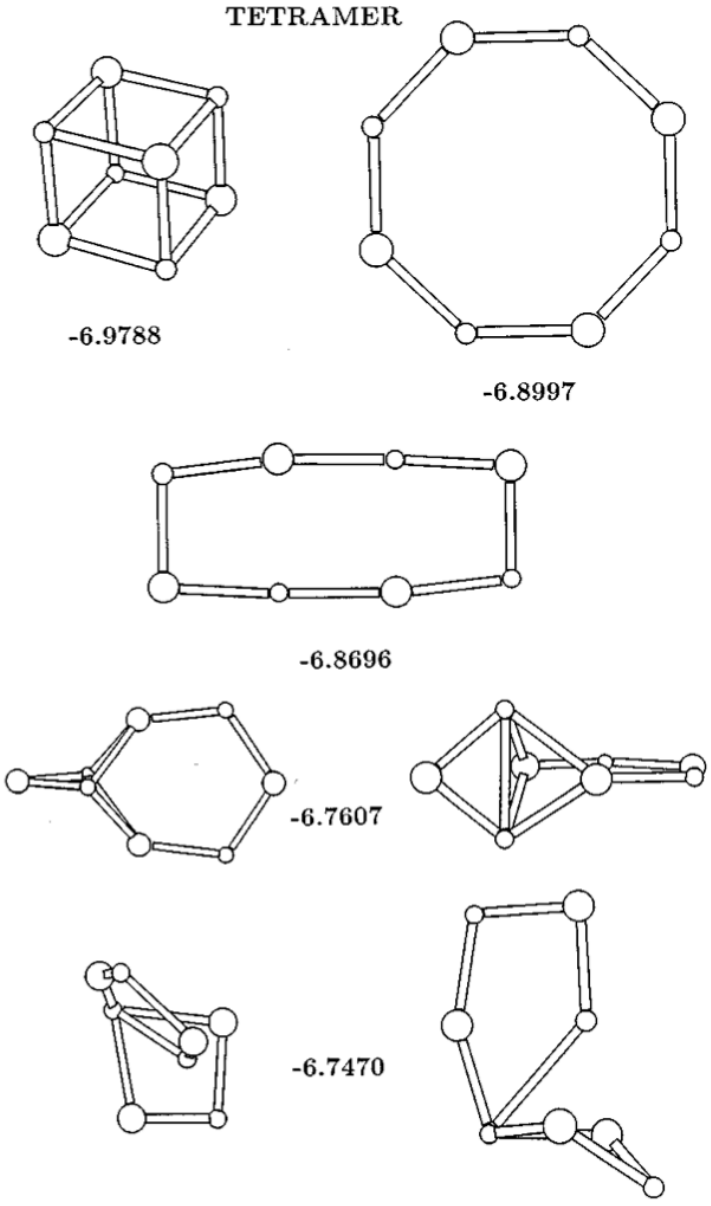


Carbon suboxide is five-atom linear molecule. Simulate a C3O2 molecule with a linear system of 5 masses and 4 ideal springs, similar to the linear triatomic molecule. There are two distinct mass values M and m , and two distinct force constants K and k. Search the web for information on the force constants. If you cannot locate data on C3O2 , make a reasonable estimate from data on Molecular Vibrations (http://www2.ess.ucla.edu/~schauble/molecular_vibrations.htm) of simpler molecules with similar bonds, for example CO2 (http://www2.ess.ucla.edu/~schauble/MoleculeHTML/CO2_html/CO2_page.html). Find the eigenfrequencies and normal modes for longitudinal oscillations.

Problem 3 NaCl:

Determine the equilibrium configurations of Na4Cl4 clusters for tetramers (n=4) in this paper: K. Michaelian, "Evolving few-ion clusters of Na and Cl",Am. J. Phys. 66, 231 (1998), shown below.

Plot the equilibrium configurations using the macros from class (x,y,z in scatter plots). Label them with their energies. Initialize them to an “ideal” case fo the geometry, and allow the optimization to work properly.



Problem 4 (505 only): CO2 again

Repeat Physics Homework 1, Problem 3 (fit to CO2 data from Mauna Loa with a quadratic function), but this time use the BFGS algorithm to perform a minimization numerically. Compare to the methods from the previous homework assignment.

DO NOT RUN THE OPTIMIZATION OVER THE CO2 X AND Y VALUES. RUN OPTIMIZATION OF THE FIT PARAMETERS.