Project 8E - Eigenvalues

Due 4-10

The goal of this exercise is to take a step towards computationally determining the eigenvalues of a matrix.

Consider a system that has two energy levels. In a given amount of time, τ, half of the electrons in level 0 get excited and jump to energy level 1. Also, in that same amount of time 10% of the electrons in level 1 drop back to level 0. Suppose we start with all of the electrons in level 0, we'd like to determine the fraction of electrons in level 0 after some time $t = N * \tau$.

1. In class: Explain (or be explained) how to determine the eigenvector corresponding to a particular eigenvalue.
2. In class: Write a set of two equations that represent the fraction of electrons in levels 0 and 1 (at the end of time τ) as a function fo the fraction of electroncs in levels 0 and 1 (at the beginning of time τ).
3. In class: Represent this set of equations in matrix form.
4. In class: By hand, determine the eigenvalues of this matrix.
5. In class: By hand, determine the eigenvectors of this matrix.
6. Computationally determine the fraction of electrons in each energy level after 3 τ. If you do not have a working matrix class with a multiply feature, use someone else's BUT CLEARLY STATE THIS AND GIVE CREDIT TO WHOSE YOU DID USE IN A COMMENT AT THE TOP OF YOUR FILE.
7. Computationally determine the fraction of electrons in each energy level after 100 τ. This should correspond to the eigenvector for the larger eigenvalue.
8. @ Review. Determine the moment of inertia of a sphere (respect to an axis through its center) of mass 10 kg and radius 0.2 m.

Due Friday, April 12th.