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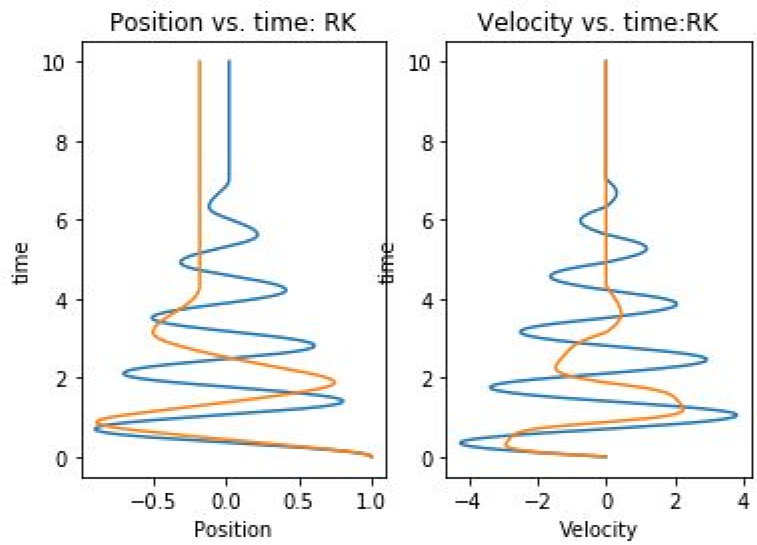
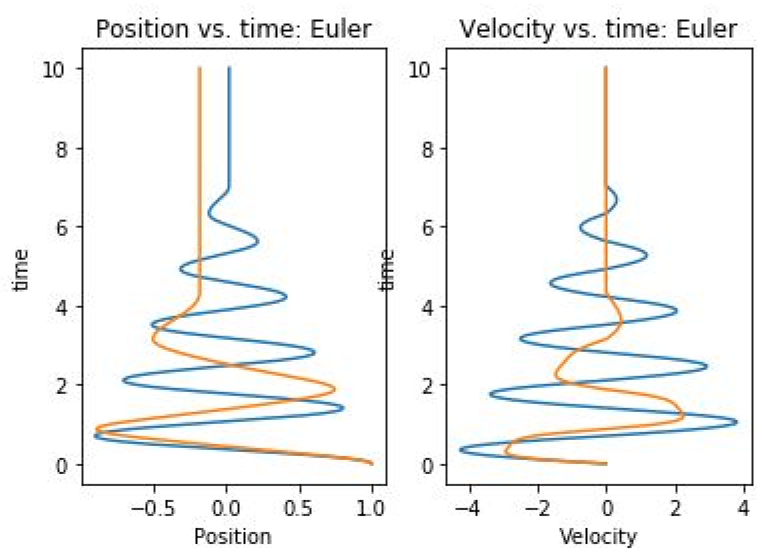
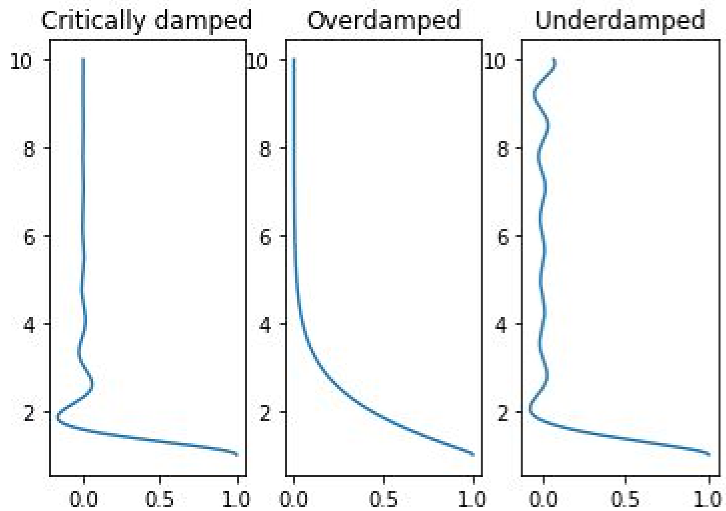
Computational
Lab 05
Ordinary Differential Equations- Non-linear Oscillations
Friction-Beats-Resonance

Part 1:
For added static and kinetic friction, the two methods, RK2 and Euler, produce the following graphs respectively:

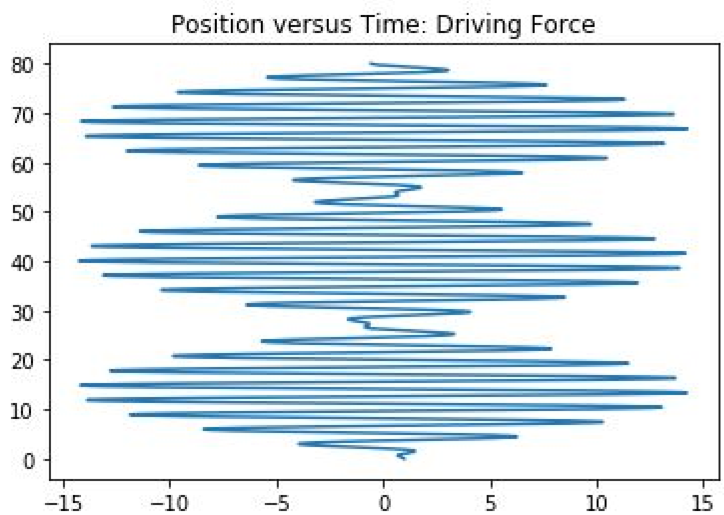


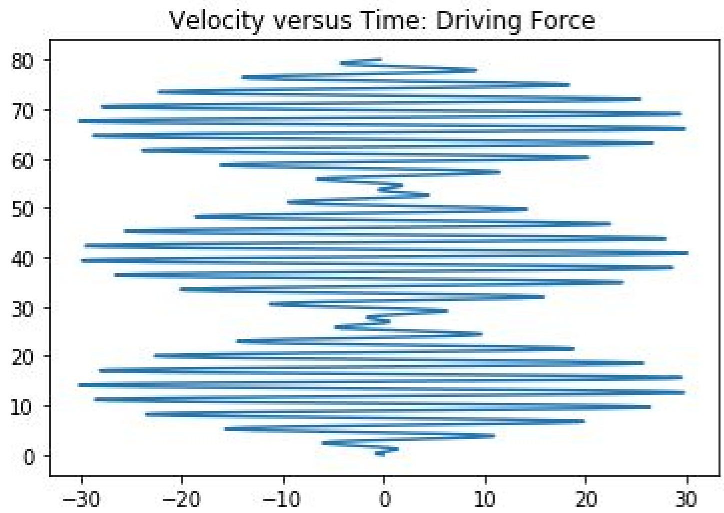


Looking at the three different scenarios for the values of b, underdamped, critically damped, and overdamped. The following are the graphs produced.



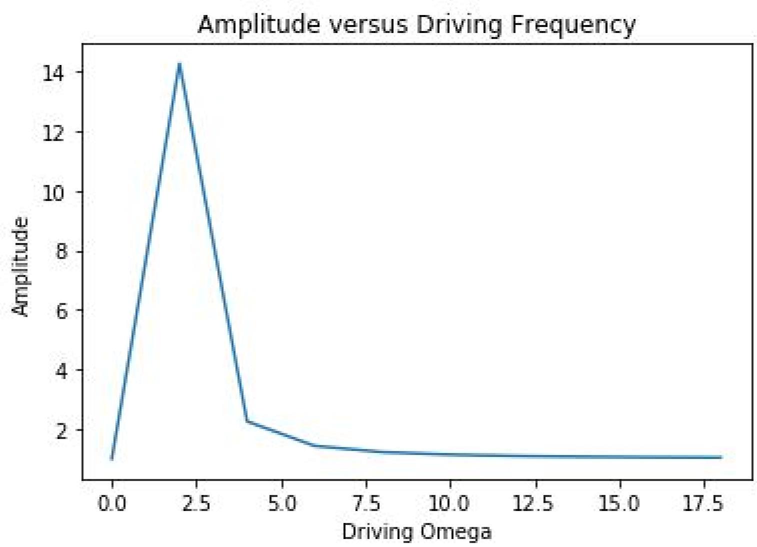
In the next sections of adding an external force, to have the mode locking, the value for F_o had to be very large, in the order of one million. This allowed the system to oscillate at this drive frequency no matter what. After than, to find where the system frequency is where the two frequencies: beat frequency and the drive frequency, are approximately equal.



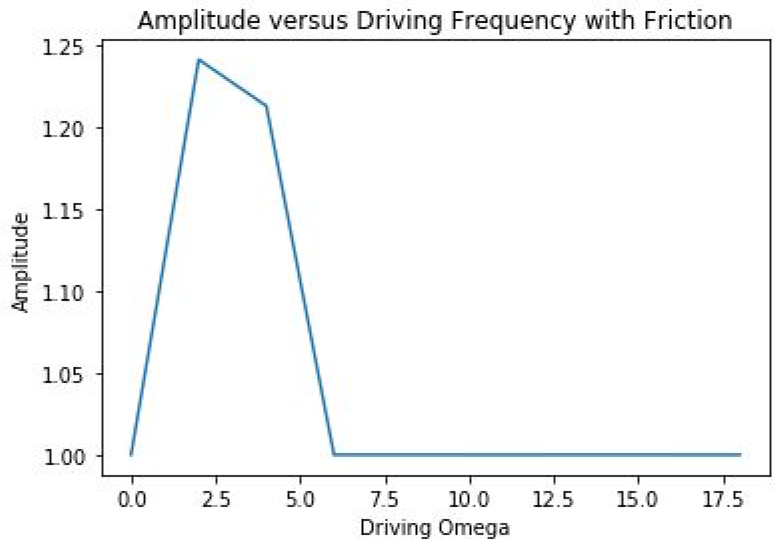


Beat Frequency: 0.037571385524797888

After running a series of different driving frequencies, the following plot shows the maximum amplitudes for each run versus the driving omega.



Now if we add the viscous friction into the system we get the following graph which does widen the curve/peak. The curve is not as smooth as expected.



Now using the driving function and varying the values for ‘P’, we find that the amplitude changes as well as the effect of the beats. As you increase the value for ‘P’, the amplitude drops and the system goes for smoother beats to less “in line” beats and more kind of chaotic driving frequencies. You can view this in the graph below. The amplitude certainly decreases and the overall shape of the beats being to fade away so to speak.