PHYS 320 Analytical Mechanics
Fall 2018

Homework Assignment # 13

- ☞ Read Taylor Sections 5.6 - 5.8
- ✪ Taylor Problems: 5.7, 5.9, 5.21, 5.22
- ✪ Extra Questions:

I. Plot the phase diagram for a damped oscillator that has a damped frequency $\omega_d = 3.0$ rad/s, an amplitude of 0.05 m, and a phase angle $\delta = 0$ for two values of damping parameter (γ): $\gamma = 0.5$ rad/s and $\gamma = 2.5$ rad/s. Use Maple and parametric plotting!

II. Consult figure 5.27 of the textbook. For one-dimensional, horizontal motion along an axis that always contains the ball (of mass, m) and the connection points of the springs to their supports, find the equivalent spring constant of the two-spring system. Assume the springs have spring constants k_1 and k_2, and that their unstretched length is $l_o < a$.

III. Maple Problem: The exact equation of motion for a simple pendulum of length L is given by

$$\ddot{\theta} + \omega_o^2 \sin\theta = 0$$

where $\omega_o = (g/L)^{1/2}$. Find $\theta(t)$ by numerically solving this equation of motion. Let $L = 1.00$ *m* and the initial conditions be such that the pendulum starts from rest at $\theta_o = \pi/2$ *rad.*

A. Plot $\theta(t)$ from $t = 0$ to 4 *s*. Also plot, on the same graph, the solution obtained by using the small angle approximation ($\sin\theta \approx \theta$).

B. Now with $\theta_o = 3.10$ *rad*, plot $\theta(t)$ from $t = 0$ to 4 *s*. Also plot, on the same graph, the solution obtained by using the small angle approximation ($\sin\theta \approx \theta$).