The Small Angle Approximation– Prelab Quiz

Answer these questions after reading the "When Approximations Fail" assignment. Be sure to show all of your work so that partial credit can be given.

1. **[4 points]** A mass of 0.250 ± 0.001kg is connected to the end of a light chord to make a pendulum. The length between the pendulum's axis of rotation and the mass is measured to be 0.800 ± 0.005m.

   Calculate the expected frequency of oscillation $\omega \pm \delta\omega$ for small angle oscillations of the pendulum. Assume that g is exactly known to be $9.81\mathrm{m}/s^2$.

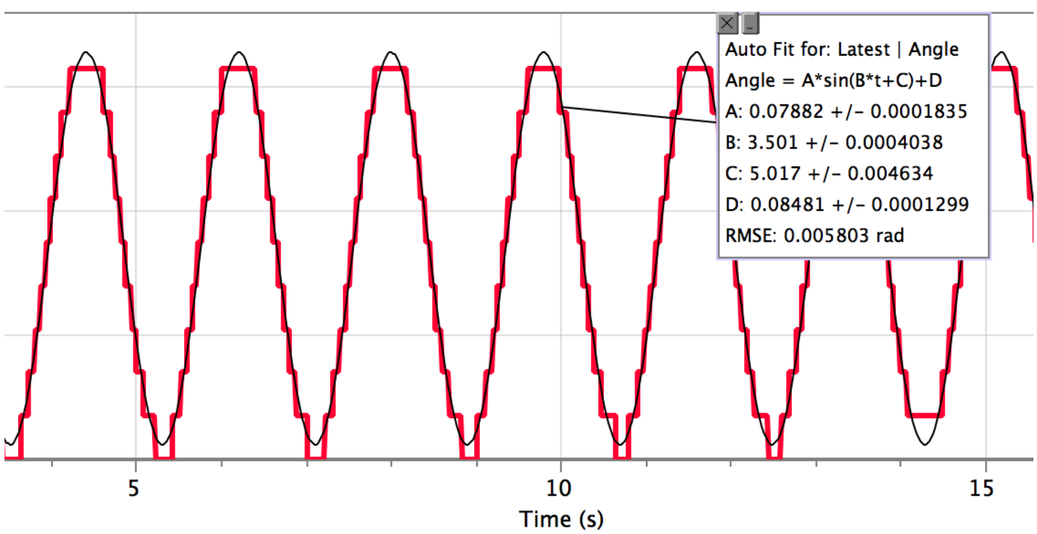

Figure 1.0: The motion of the pendulum is recorded using a digital rotary motion sensor. The data are shown in red. The data are fit with a sinusoid function of the form: `A*sin(B*t+C)+D` – thin black line. The resulting parameters obtained from the fit are displayed in the dialogue box.

2. **[3 points]** The angular position of a pendulum is measured using a Vernier rotary motion sensor. The data collected are the opening angle of the pendulum – with respect to vertical – measured in units of radians. The data are fit as shown in Figure 1.0.

Based on the results of the fit. What is the observed amplitude of the pendulum and the associated uncertainty (expressed in degrees)? What is the observed angular frequency and associated uncertainty (expressed in radians per second)?

3. **[3 points]** Assume that the data presented in Figure 1.0 were collected using the same pendulum as the one described in Exercise 1. How does the observed frequency in Exercise 2 compare to the theoretical frequency calculated in Exercise 1? Are the two frequencies compatible? Justify your answer.