Coverage: Sinusoids

Instructions

- Review the "Problem Set Procedures and Grading Rubric" on Moodle. Pay special attention to the format requirements to avoid needless point deductions.
- Install the "SPFirst" MATLAB toolbox. See instructions on Moodle. Type "sindrill" at the MATLAB prompt to verify proper installation.
- Explore the contents of the textbook companion site at dspfirst.gatech.edu. Look for the large number of worked examples similar to the assigned problems.

Problems

Plot problems 1 - 3 by hand.

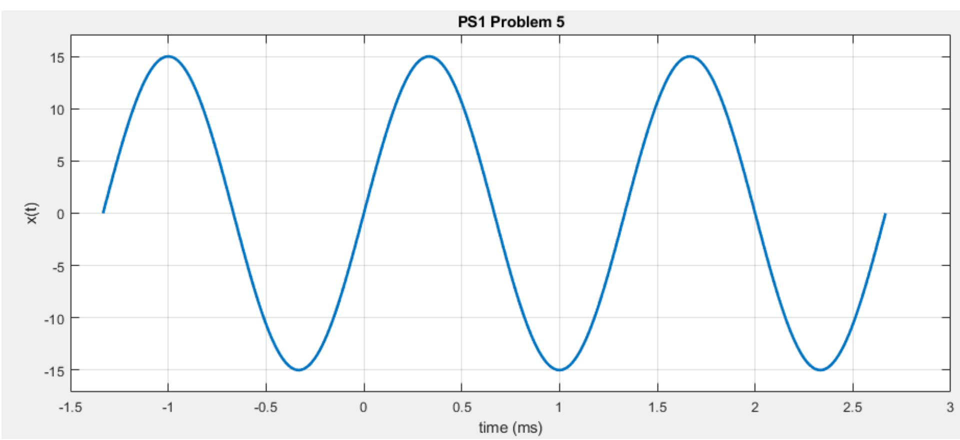
(1) End-of-chapter problem P-2.1

(2) Repeat 1, using $x(t) = 25\cos(2\pi 200t - 0.75\pi)$. Use a time range long enough to plot several cycles and include the time origin $t = 0$.

(3) Repeat 1, using $x(t) = \sqrt{19}\cos(2.10^6\pi t + 0.25\pi)$. Adjust the time scale to microseconds as the time unit and to plot several cycles as before with origin $t = 0$

(4) End-of-chapter problem P-2.2

(5) Repeat 4 for the following sinusoidal signal.



(6) Confirm your work on problems 1 - 5 with MATLAB as follows:

- Problems 1, 2, and 3:
  - Plot the sinusoids for several cycles; include t=0 as well as negative and positive time

- Define the variables A (amplitude), f_Hz (frequency; the underscore followed by the unit makes the variable name self-documenting), and phi_rad(phase angle in radians)
- Create an array of time samples with units of seconds tt_s to serve as the independent axis:

```
tt_s = tstart : tstep : tfinal;
```

  where `tstart` is the initial time, `tfinal` is the final time, and `tstep` is the step size, that is, the time interval between individual time samples; the sinusoid's period divided by 100 works well for the step size to produce a smooth-looking trace
- Calculate the sinusoidal signal as an array of samples (x is generated as an array because `tt_s` is an array, all the other variables are scalars):

```
x = A*cos(2*pi*f_Hz*tt_s + phi_rad);
```

- Include axis labels and units on the plot
- Plot higher-frequency sinusoids with more convenient time units such as milliseconds or microseconds by scaling the time axis, for example, plot (tt_s*1e3,x) plots the signal x as a function of time in milliseconds
- Adjust the line thickness of the signal trace like this: plot(tt_s,x,'LineWidth',*n*) where the number *n* defines the thickness (n=2 often works well)
- Insert a "data tip" label at the positive peak closest to t=0 to display the amplitude and time shift as a check on your previous calculations; simply click on the signal trace to place the data tip label (it is movable, too)

➢ Problems 4 and 5:

- Plot the sinusoids based on the three values you found (A, ω_0, and ϕ)
- Follow the remaining guidelines established above

➢ Problems 1 through 5:

- Screen clip each plot and associated .m code onto a single page for each problem
- Attach the five hardcopy pages to the end of your problem set
- No need to write the usual "Given – Find – Solution" section heading