ECE/TAM 473
Homework Assignment #1
Due: Friday, August 31, 2018

1. Let $x = e^{-\beta t}\left(A_1 \cos \omega t + A_2 \sin \omega t\right)$. Show that $x(t) = Ae^{-\beta t}\cos\left(\omega t + \phi\right)$. Evaluate the constants A and ϕ in terms of A_1 and A_2, then define (using A and ϕ) u(t) and a(t) (speed and acceleration). Plot x(t), u(t) and a(t) (with A = 1, $\phi = \pi$, $\beta = 1/(2\pi)$, and $\omega = 2$) over the range of t = 0 to 3π. What is the phase difference between x(t) and u(t), u(t) and a(t), x(t) and a(t)?

2. Given that $\tilde{A} = Ae^{j(\omega t+\phi)}$ and $\tilde{B} = \left(\sqrt{x} + j\sqrt{y}\right)^2$, find (a) the magnitude of $\tilde{A}$, (b) the magnitude of $\tilde{B}$, (c) the real part of $\tilde{A}\tilde{B}$, (d) the magnitude of $\tilde{A}\tilde{B}$, (e) the real part of $\tilde{A}/\tilde{B}$, (f) the phase of $\tilde{A}\tilde{B}$.

3. Problem 1.2.1 in Kinsler et al. (p. 31), determine both the restoring force and the natural frequency.

4. Problem 1.3.2 in Kinsler et al. (p.31).

Note: A good plot involves scaling wherein the interesting features of the graph nicely occupy the available paper area, with appropriate labeling of the axes.

Note to graduate students taking the course for 4 credit hours: For the additional unit of credit, you are required to write a paper (typically about 8-10 pages, double spaced) that discusses in some detail any topic on acoustics for which the fundamentals of engineering acoustics are explicitly described (this should be a Typed Paper on Sound or what I like to call the **TPS report**). The paper is typically a summary of some acoustic topic and based on 4-5 peer-reviewed publications. The paper will be due Dec 12, 2018. However, topic and publications must be approved by me. For the approval process, prepare a one-page outline (including 4-5 peer-reviewed references) for submission **October 26, 2018**. And uh, if you could put a cover sheet on the TPS report, that would be great, ok…