ECE 3510 homework # 6 Due: Thur, 2/2/06 a

1. Given the conditions in example 3.4.3, p.40,

   a) Show all the steps needed to find eq. 3.57.

   b) Use the Laplace transform table to find the results in eq. 3.58 and 3.59 ($y_{ss}(t)$ part).

   c) Show that equations 3.60 can be found from equations 3.59.

   d) Show that eq. 3.60 can be found from steady-state analysis of $H(s)$ (see eq. 3.53).

2. Still referring to the system in example 3.4.3, p.40,

   a) For the input: $x(t) = x_m \cdot \sin(\omega_o \cdot t)$ confirm eq. 3.63.

   b) Use any method you want to find M and ϕ_2 in: $y_{ss}(t) = M \cdot x_m \cdot \cos(\omega_o \cdot t + \phi_2)$

   You may want to recall that: $\sin(\omega_o \cdot t) = \cos(\omega_o \cdot t - 90 \cdot deg)$

3. The following questions refer to the general system whose output is given by eq. 3.71, p.42 in our text.

   a) Can a system's response to initial conditions be calculated separately from its response to the input signal? Why or why not?

   b) Can you expect a system's response to initial conditions to be similar to its response to a simple input signal? Why or why not?

   c) To fully describe the state of the system, how many things do you need to know?

   List them.

   d) If a system is BIBO stable, then what is its final response to initial conditions?

   e) The output of a system with nonrepeated poles on the jω-axis which is otherwise BIBO stable can be unbounded for some input signals. Is this also true for initial conditions alone when there is no input signal?
   If no, why can are the conditions for bounded output not as restrictive if there are only initial conditions and no input?

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