EE241: COMPUTER TOOLS FOR ELECTRICAL ENGINEERS
PROJECT-2 Due: December 22, 2016

ANALOG COMPUTER

Wikipedia definition: An analog computer is a form of computer that uses the continuously changeable aspects of physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved. (https://en.wikipedia.org/wiki/Analog_computer)

Electronic analog computers are used to solve differential equations modeling a physical system. An electronic analog computer can be built using OPAMPs (as processing elements), voltage sources (to emulate inputs) and oscilloscopes (to visualize outputs).

Your task is to design an analog computer using PSPICE to solve the differential equation described in eqn. 1.

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = 1; \qquad x(0) = 0.1; \qquad \dot{x}(0) = 0.05 \tag{1}$$

a) First, you should build a Simulink model including *gain*, *summer*, *and integrator* elements to solve equation 1.
b) Then, please design an OPAMP circuit using PSPICE that includes all the elements (i.e., gain elements, summer/subtractor elements and integrators) you have in your Simulink model. You should implement OPAMP(s) using voltage controlled voltage sources with the following values: Rin=1 MΩ, Rout=100 Ω, gain=10^4 V/V.
c) Finally, replace your OPAMP(s) with AD8608 from Analog Devices. You can obtain the SPICE model of AD8608 on http://www.analog.com

Please return a short report including

- a screen shot of your Simulink model and time trace of variable *x*.
- a screen shot of the schematics of your design on PSPICE and time trace of variable *x*.
- a discussion regarding any discrepancies between the outputs of your Simulink and PSPICE models.

Two classical books on analog computers:

1. Peterson, Gerald R., Basic analog computation, Macmillan, 1967
2. Stice, James E., Electronic analog computer primer , Blaisdell Pub. Co., 1965.

Reminder: By returning this homework assignment you have agreed that you, in person, are fully responsible for the consequences of violating the rules of conduct. As a university student, you are expected to act maturely and responsibly. In short, **do not cheat!**

Please remember to upload all the relevant files as a single zip archive on CIMS until December 22nd 23:59 and as a hardcopy to your instructors on December 23rd until 15:00.

Hard copy must include the following statement and should be signed:

"I have neither given nor received any unauthorized aid on this assignment."