APPLIED PHYSICS 183 THIRD LONG EXAM TAKE-HOME DUE MAY 15, 2019

INSTRUCTIONS:

1. For each exam question write your answers in a separate pdf document. Your exam may be graded by different checkers and your answers need to be distributed to them.
2. Name your pdf files in the following format:

   <Surname><Firstname>_<question_no.>_AP183_LE3.pdf

   For example, for my answers to question no 2 the filename is SorianoMaricor_2_AP183_LE3.pdf
3. Submit your answers in UVLE no later than 11:55PM of Wednesday May 15, 2019.

QUESTIONNAIRE:

1. Use the last 4 numbers [a b c d] of your cellphone to form a transfer function given by

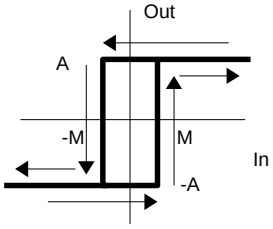
$$G(s)=\frac{a+1}{bs^3+cs^2+ds}.$$

For example, my phone number is 09209083305, my last 4 numbers are [3 3 0 5] and my G(s) is

$$G(s)=\frac{4}{3s^3+5s}\quad .$$

Design a lead compensator to produce a step response with a peak time at 0.1 sec and overshoot of no more than 10%.
Score distribution:
a) Desired pole location (2 pts)
b) Angle deficiency (2 pts)
c) Compensator zero and pole, z_c and p_c (4 pts)
d) Compensator gain K (2 pts)
e) VisSim implementation (5 pts)

2. Compute the describing function of a hysteresis with input-output curve shown below. The input sinusoid is $M\sin\omega t$. The edge of the hysteresis are at M and -M.



Score distribution:
a) Sketch of output (5 pts)
b) Fourier coefficients A_1 and B_1 (7 pts)
c) Describing function N (3 pts)

3. Determine if a limit cycle exists if the hysteresis in No. 2 is cascaded with a process $G(s)=\frac{5}{s(1+s)^2}$ in a negative feedback loop.
Score distribution:
a) Calculation for ω (5 pts)
b) Calculation for M (5 pts)
c) Conclusion (5 pts)