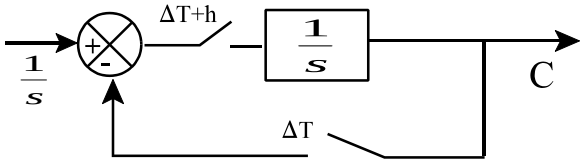
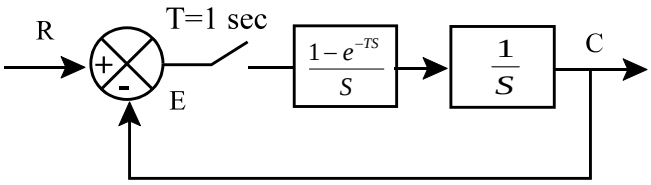
EE 432- 1 Digital Control Systems, Final

Sunday, January 20, 2008, 7:00 AM - 9:00 AM Dr. Ahmad A. Masoud

Q1 (5 marks): consider the system shown below with a unit step input a main sampler with sampling period ΔT=1 sec, and an offset sampler with the same sampling period and an offset h=.1 sec. Derive C(Z) for the system.



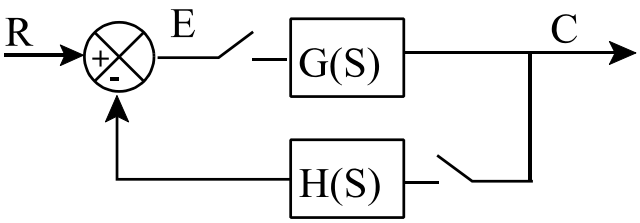
Q2 (8 marks): Consider the system shown below with a unit step input:



1- compute the steady state value of C(t), $\lim_{t\to\infty} C(t)$. (4 marks)

2- Derive an expression for the continuous time unit step response C(t)) of the system (4 marks)

Q3 (5 marks): Derive the characteristic equation of the system shown below:



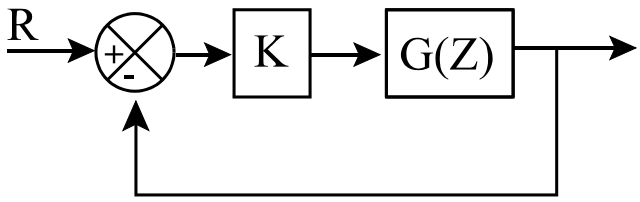
Q4 (12 marks): or the following cases determine whether a digital system is stable or not:

1- Use the modified Routh-Horowitz with the system: $\frac{1}{Z^3 + 2.5 \cdot Z^2 + 1.96 \cdot Z + 0.48}$ (2.5 marks)

2- Use the Jury-test with the system: $\frac{1}{Z^3 + 2.2 \cdot Z^2 + 1.57 \cdot Z + 0.36}$ (2.5 marks)

3- A discrete, unity feedback system with forward transfer function G(Z). G(Z) has one pole inside the unit circle and another outside of it. The contour α which results from mapping 1+G(Z) using the Nyquist contour Γ (Γ is clockwise) encircles the origin twice in the counter clock wise direction. Is the closed loop system stable or not and explain why. (3 marks)

4- consider the digital system with the variable forward gain K shown below: (4 marks)



The root-locus of the above system is shown below. Compute the region positive values of K for which the system is stable.