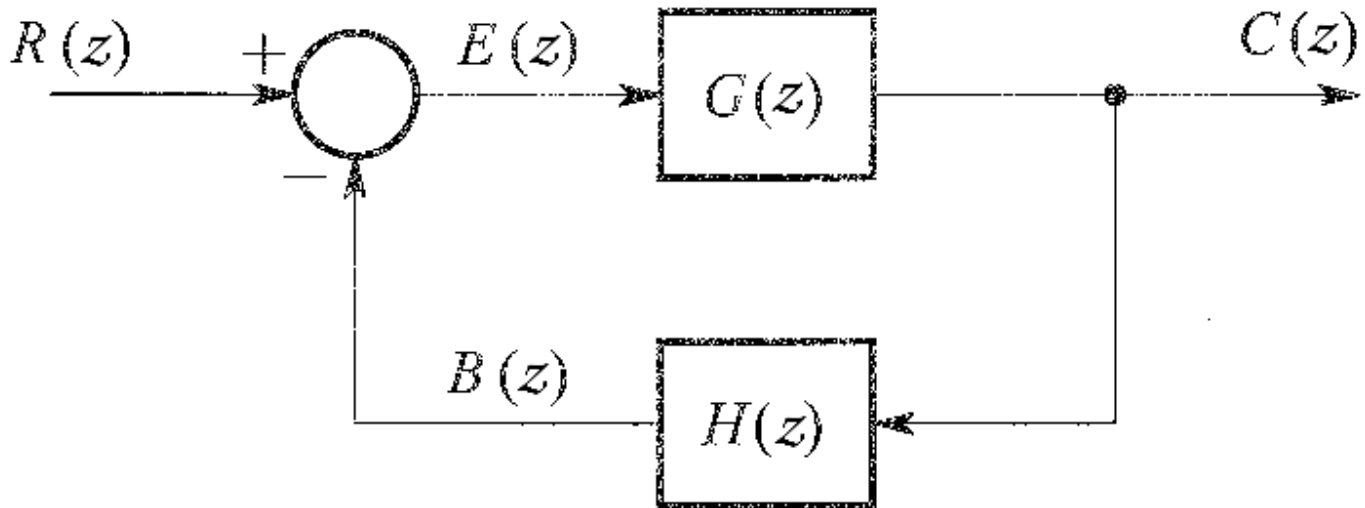


Signal Theory 48541 - Advanced Assignment

Note: Please refer to the subject outline for details regarding the assessment of the advanced assignment.

Using the standard form of a feedback control system shown below, assume that the system to be studied is a linear time-invariant discrete-time system.



In the diagram above, $R(z)$ is the z -transform of the system's input $r[n]$, $C(z)$ is the z -transform of the system's output $c[n]$, and $G(z)$ and $H(z)$ are the transfer functions of the subsystems given by:

$$G(z) = z / (z+1)$$

$$H(z) = 9 / (z-8)$$

(a) Determine the unit-pulse response of the overall system. [3 marks]

(b) Compute the step response of the overall system. [3 marks]

(c) Compute $c[n]$ when $r[n]=(0.5)^n u[n]$ with $c[-1]=-3$, $c[-2]=4$; Hint: In order to incorporate the initial conditions into your solution, you need to revert to the difference equation (hint: cross multiply the transfer function). Once the difference equation is obtained, the z -transform can be taken to obtain the initial condition terms. [8 marks]

(d) Compute $c[n]$ when $r[n]=(0.5)^n u[n]$ with $c[-2]=1$, $b[-1]=2$, where $b[n]$ is the output of block $H(z)$; Hint: Determine $c[-1]$ by obtaining a difference equation with $c[n]$ and $b[n]$ terms (you need an equation with $C(z)$ and $B(z)$). Then substitute $c[-1]$ into the result you obtained for $C(z)$ in part (c). [6 marks]

Warning

This assignment *must* be completed on an individual basis - that is, you cannot obtain help from other students or from staff. (Your tutor is able, however, to help you in your *understanding* of the question.)

Anyone found using someone else's work will be subject to the disciplinary processes of the University. Please do not risk it.

Please note also you must be able to explain your work (in detail) if asked to do so. If you are unable to do so, it will be assumed you have used someone else's work and you will face the same disciplinary processes as above. Again, it's not worth the risk of receiving 0Z for the subject, or 0Z for all subjects in which you are enrolled, or suspension or even expulsion from the University.

Completing this assignment in no way affects whether you pass or fail the subject (please see the Subject Outline for more details).