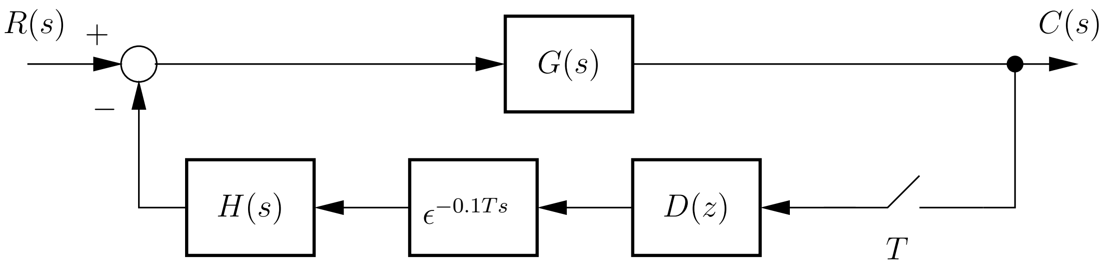
EE 233 Homework 6.

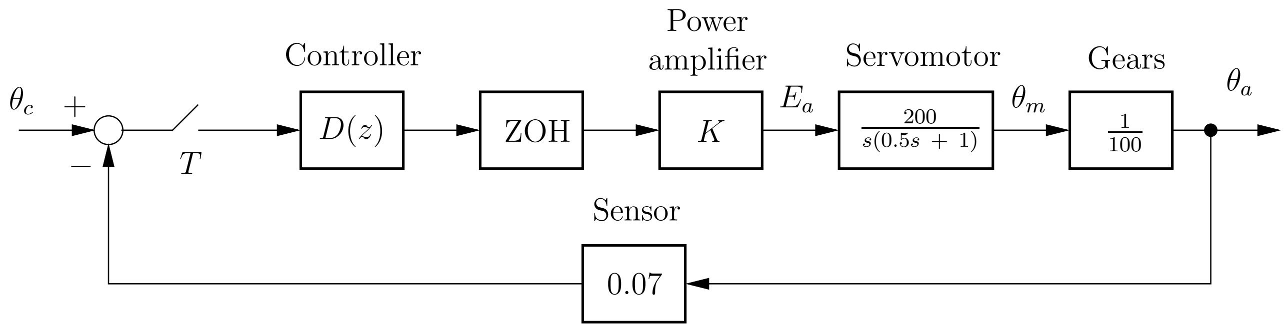
5-11. In the system below, the ideal time delay represents the time required to complete the computations in the computer.



a. Derive the output function $C(z)$ for this system.

b. Suppose that the ideal delay is associated with the sensor rather that the computer, and the position of $H(s)$ and the ideal delay ar reversed. Find $C(z)$ for this case.

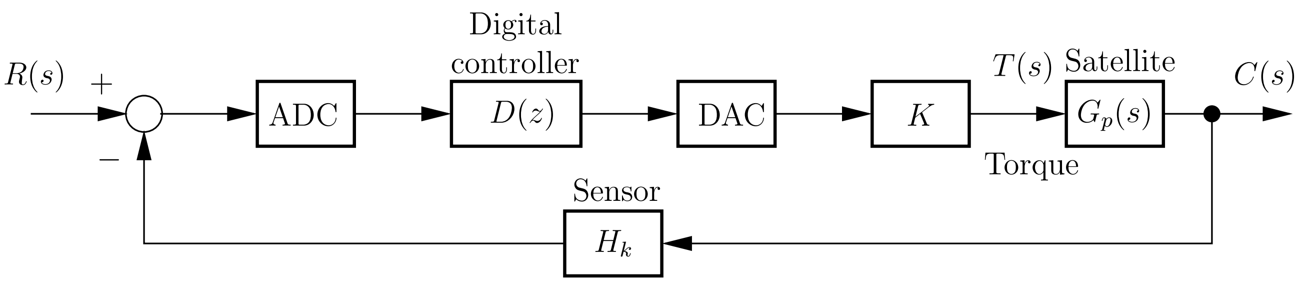
5-13. Consider the robot-joint control system below.



a. Find the system transfer function in terms of T, $D(z)$ and K.

b. Evaluate the system transfer function for $T = 0.1$ s, $K = 2.4$ and $D(z) = 1$.

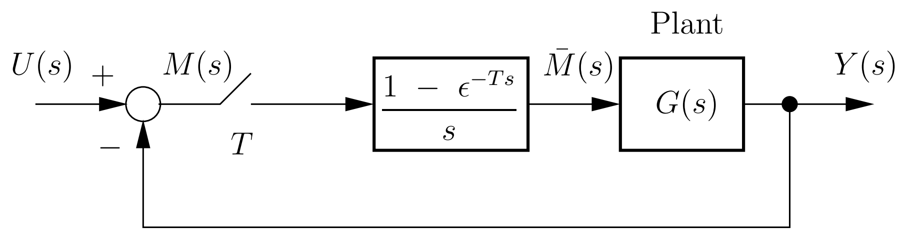
5-14. Consider the satellite control system below. Let $H_k = 0.0.2$.



a. Find the system transfer function in terms of $D(z)$, K and H_k.

b. Evaluate the system transfer function for $D(z) = 1$, $K = 2$ and $T = 1$.

5-20. Suppose that the plant in the following figure



has the discrete state model

$$
\begin{aligned}
x(k+1) &= Ax(k) + Bm(k) \\
y(k) &= Cx(k) + Dm(k)
\end{aligned}
$$

Derive the state model for the closed-loop system in terms of A, B, C and D.

5-21. Find a discrete state variable model of the closed-loop system in Problem 5-20 if the discrete state model of the plant is given by

a.

$$
\begin{aligned}
x(k+1) &= 0.7x(k) + 0.3m(k) \\
y(k) &= 0.2x(k) + 0.5u(k)
\end{aligned}
$$

b.

$$
\begin{aligned}
x(k+1) &= \begin{bmatrix} 0 & 1 \\ -0.9 & 1.3 \end{bmatrix} x(k) + \begin{bmatrix} 0.1 \\ 0.05 \end{bmatrix} m(k) \\
y(k) &= \begin{bmatrix} 1.2 & -0.7 \end{bmatrix} x(k)
\end{aligned}
$$

c.

$$
\begin{aligned}
x(k+1) &= \begin{bmatrix} 0.5 & 0 & 0 \\ 0 & 0.9 & 1 \\ -1 & 0 & 0.9 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} m(k) \\
y(k) &= \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x(k)
\end{aligned}
$$