TD 2 Representation of Sampled data Control Systems

Exercise N°1 :

Discretize the following continuous time transfer function : $G(s) = \frac{1}{(1+10s)}$ using the following methods :

a) Zero order hold (ZOH).

b) Approximation of **Tustin**.

c) Backward Approximation of **Euler**.

d) Forward Approximation of **Euler**.

Exercise N°2 :

1. Given the following sampled data (discrete) transfer function:

$$F(z) = \frac{b_1 z^2 + b_2}{a_1 z^2 + a_2 z + a_3}$$

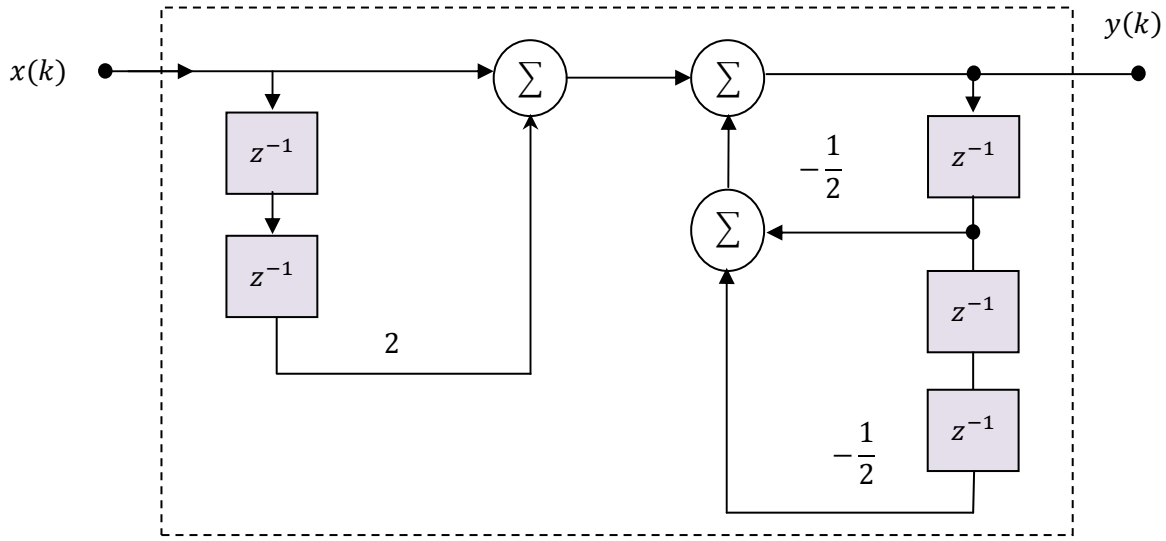
a) Determine the corresponding difference equation representing the system.

b) Draw the corresponding block diagram representing the system.

2. Draw the block diagram representing the LTI discrete system described by the following difference equation:

$$y(k) + \frac{1}{4}y(k-1) + \frac{1}{8}y(k-2) = x(k) + x(k-1)$$

3. Given the discrete LTI system defined by the following block diagram :



a. Deduce the corresponding difference equation of the system.

b. Deduce the corresponding discrete transfer function: $F(z) = \frac{Y(z)}{X(z)}$.

c. Determine the order, zeros, poles and the gain of the discrete system.

d. Simplify, if possible, the previous block diagram representing the system.

Exercise N°3 :

Consider the discrete LTI system represented by the following given block diagram :

1. From the block diagram, obtain the sampled data transfer function: $F(z) = \frac{Y(z)}{X(z)}$.

2. Indicate the order of the system.

3. Identify the zeros, poles and the gain of the system.

4. Deduce thereafter the corresponding difference equation of the system.

5. Calculate the open loop impulse response of the system.

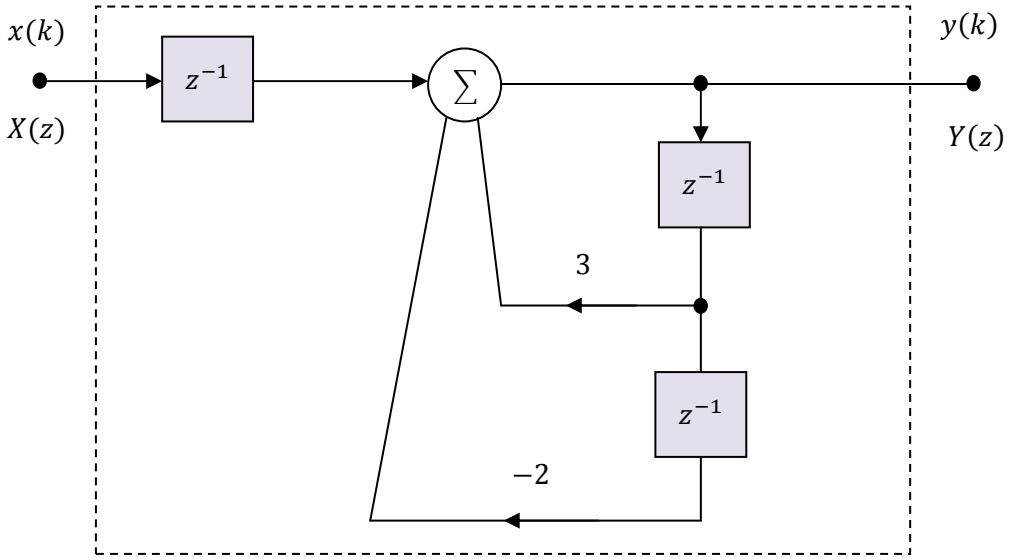
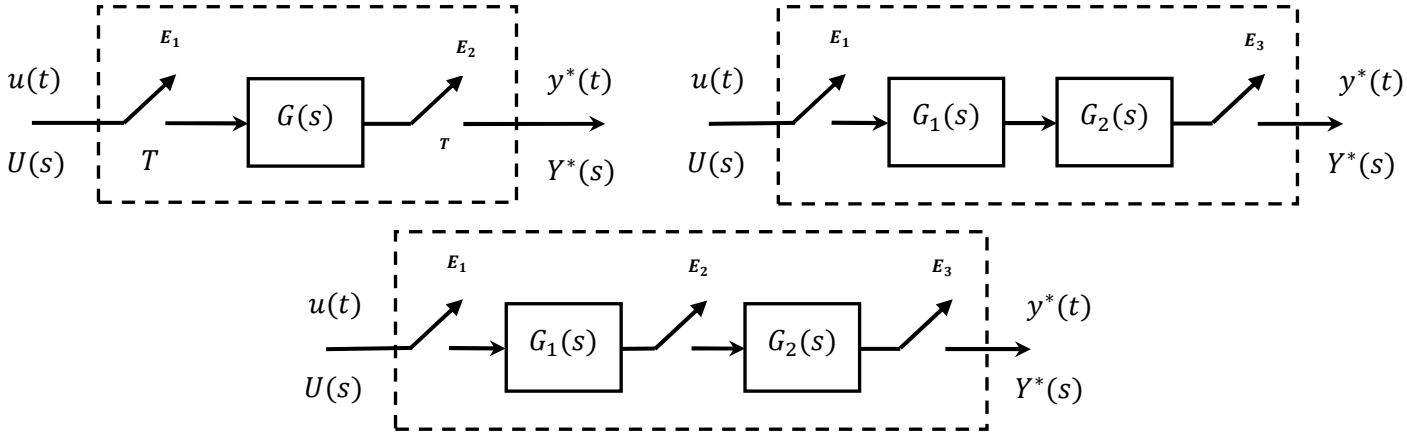


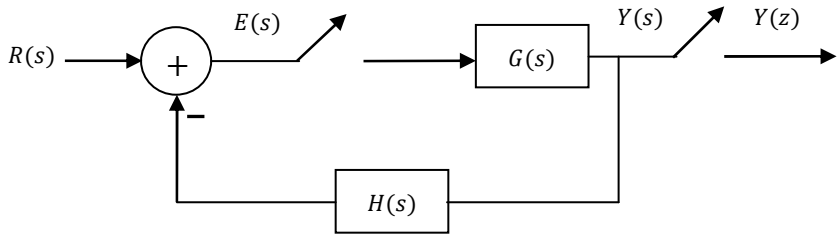
Fig.3

Exercise N° 4:

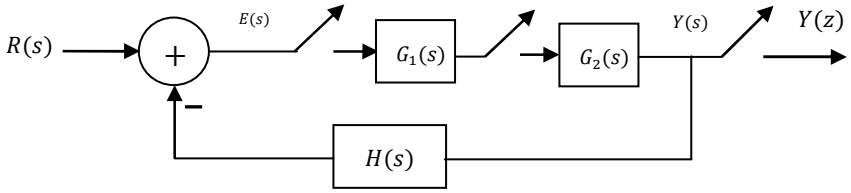
1. Find the discrete (sampled data) transfer function $G(z) = \frac{Y(z)}{U(z)}$ corresponding to each of the following cases:



2. determine the discrete output Y(*z*) for each of the following block diagrams (a) and (b):



(a)



(b)