# 從信號與系統到控制

## 單元：離散控制-2

## 用基本元件 建立 離散時間系統

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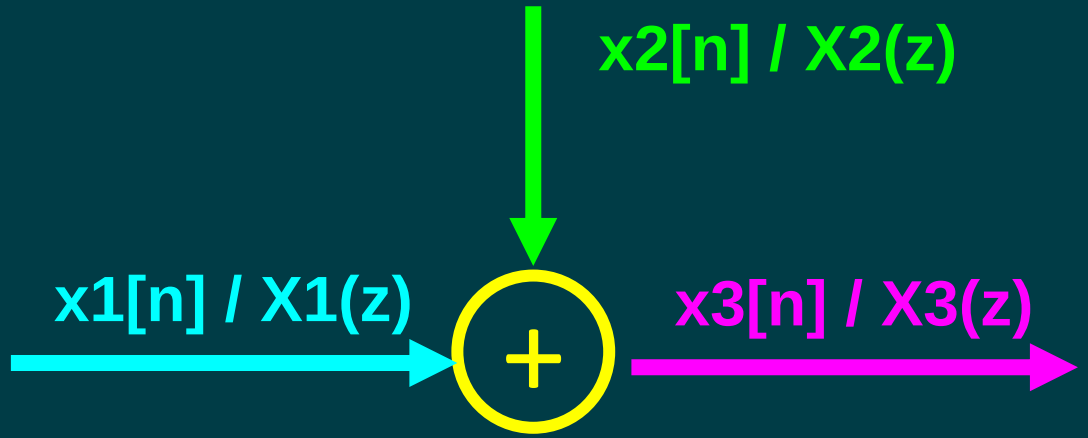
# 單元學習目標與大綱

- 討論用基本元件來建立一個離散時間系統
- 離散時間：加法、增益、超前、延遲

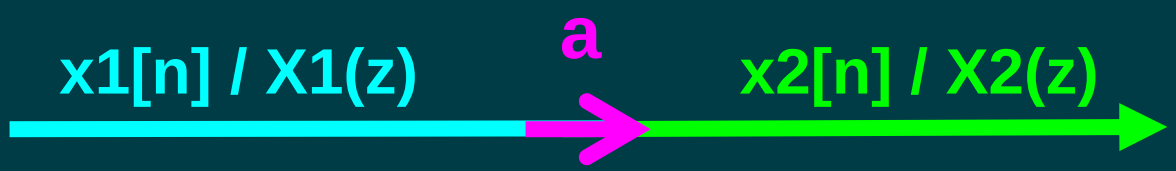
# 建立系統的基本元件 – 加法器




$$x3[n] = x1[n] + x2[n]$$

$$X3(z) = X1(z) + X2(z)$$

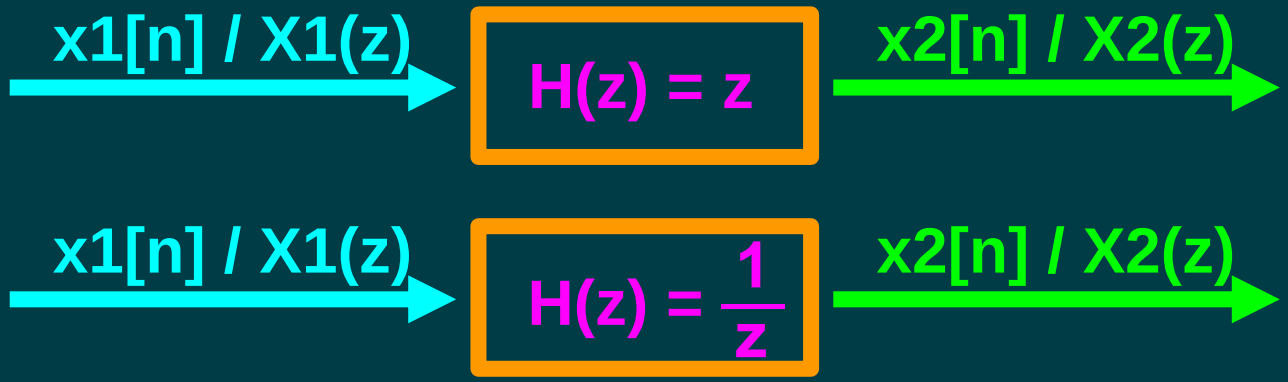
# 建立系統的基本元件 – 增益




$$x2[n] = a\ x1[n]$$

$$X2(z) = a\ X1(z)$$

# 建立系統的基本元件 – 超前與延遲



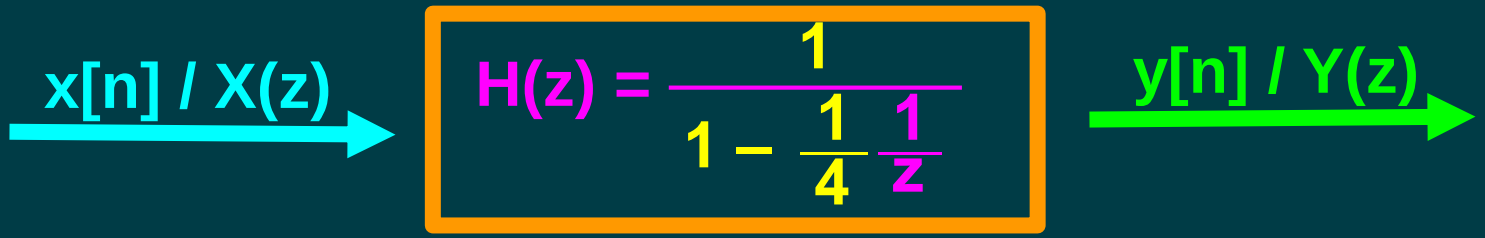

$X2(z) = z\ X1(z)$

$x2[n] = x1[n+1]$

$X2(z) = \frac{1}{z}\ X1(z)$

$x2[n] = x1[n-1]$

# 離散時間系統的範例



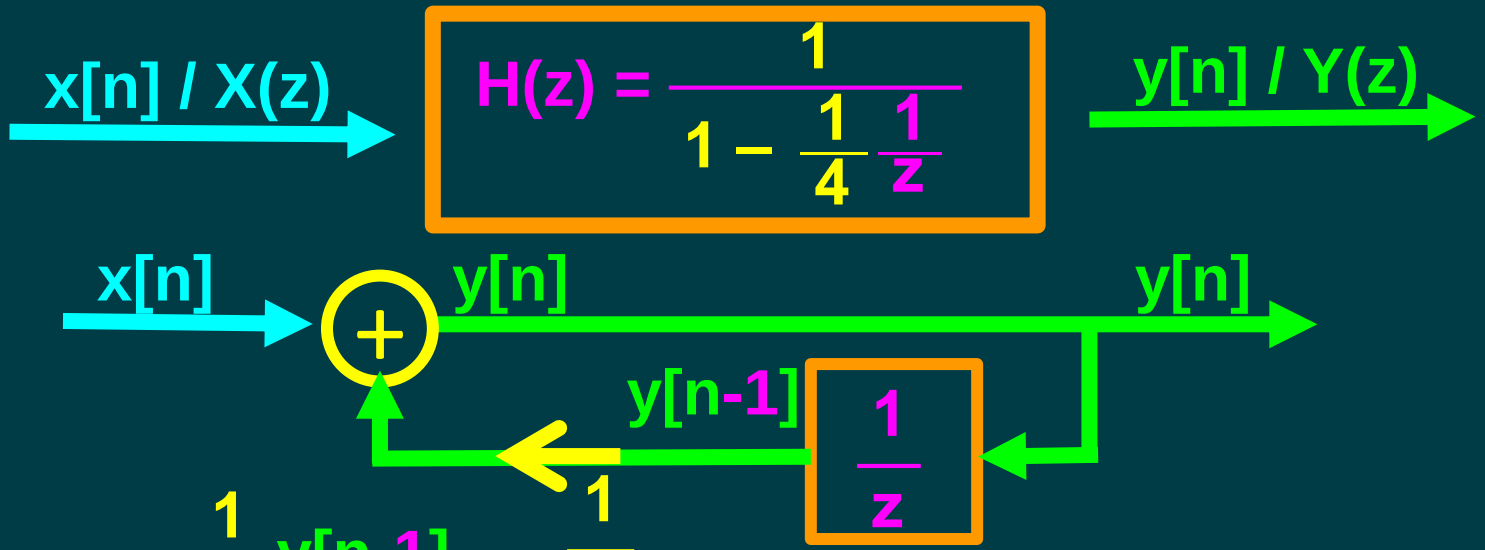

$$Y(z) = \frac{1}{1 - \frac{1}{4}\frac{1}{z}} X(z)$$

$$\left(1 - \frac{1}{4}\frac{1}{z}\right) Y(z) = X(z)$$

$$Y(z) - \frac{1}{4}\frac{1}{z} Y(z) = X(z)$$

$$y[n] - \frac{1}{4} y[n-1] = x[n]$$

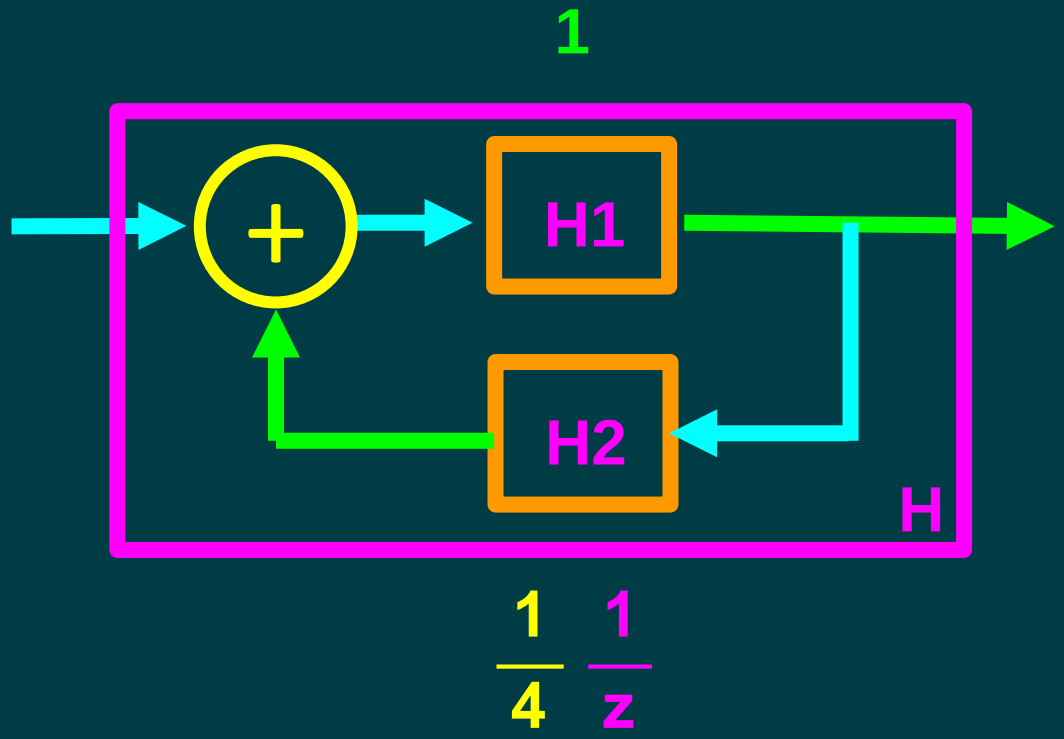
# 離散時間系統的範例




$$y[n] = x[n] + \frac{1}{4} y[n-1]$$

$$y[n] - \frac{1}{4} y[n-1] = x[n]$$

# 兩個系統的連接 – 迴授




$$H = \frac{H1}{(1 - H1 \bullet H2)}$$

$$= \frac{1}{(1 - 1 \bullet \frac{1}{4}\frac{1}{z})}$$

$$= \frac{1}{(1 - \frac{1}{4}\frac{1}{z})}$$

# 離散時間系統的範例

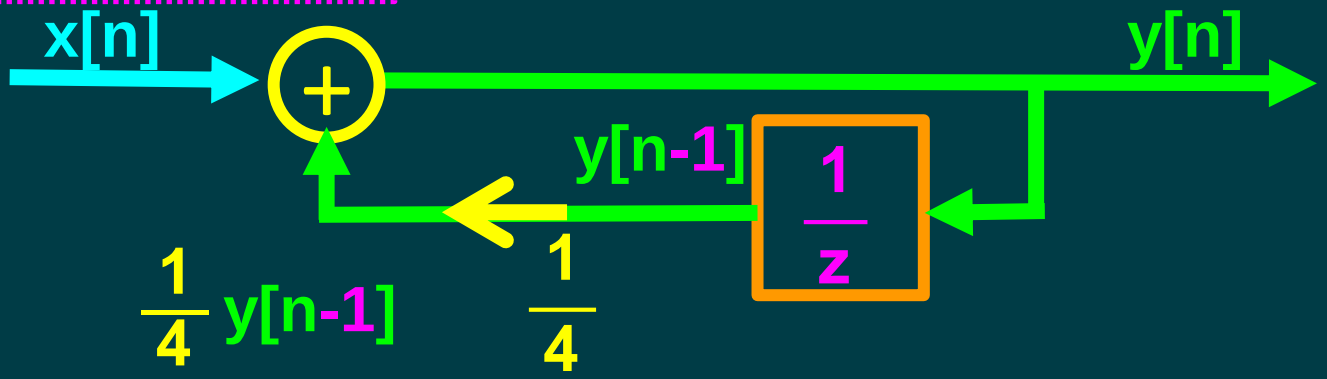
$x[n] / X(z)$

$$H(z) = \frac{1}{1 - \frac{1}{4}\frac{1}{z}}$$

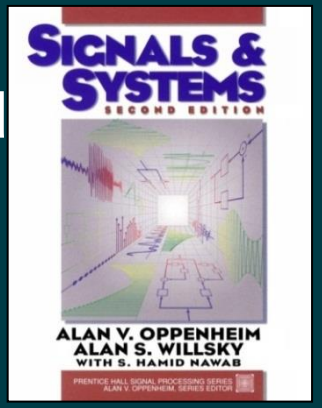
$y[n] / Y(z)$

$$y[n] = x[n] + \frac{1}{4} y[n-1]$$

$$Y(z) = \frac{1}{1 - \frac{1}{4}\frac{1}{z}} X(z)$$



# 參考文獻




- Alan V. Oppenheim, Alan S. Willsky, S. Hamid
  **Signals & Systems**,
  Prentice Hall, 2nd Edition, 1997

- **SciLab**:
  Open source software for numerical computation
  http://www.scilab.org/