

# 從信號與系統到控制

## 單元：連續控制-1

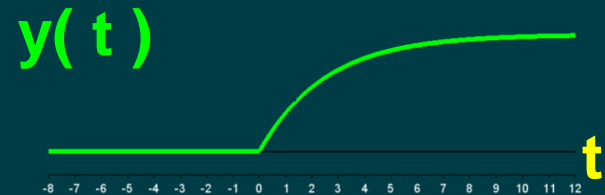
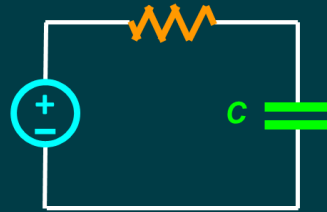
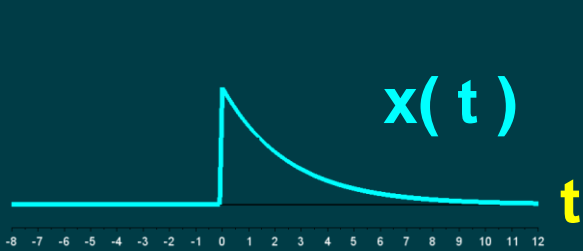
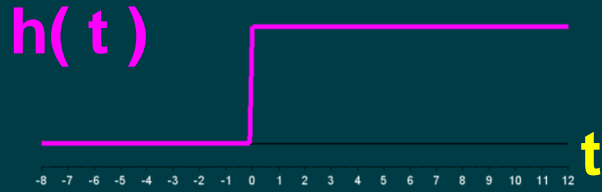
### 連續時間系統 方塊圖表示法

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# 單元學習目標與大綱

- 用**方塊圖**來表示一個連續時間的系統
- 兩個系統的連接方式：**串聯 並聯 迴授**

# 連續時間的信號與系統



# 連續時間的信號與系統

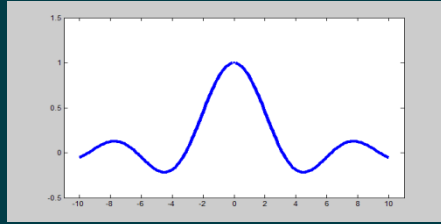
連續時間

$x(t)$

$X(s)$

輸入信號

Input Signal



$t \in \mathbb{R}$

$h(t)$

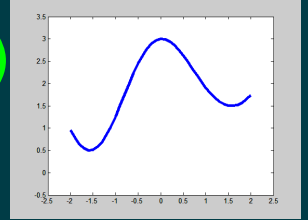
$H(s)$

$y(t)$

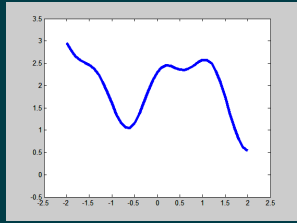
$Y(s)$

輸出信號

Output Signal



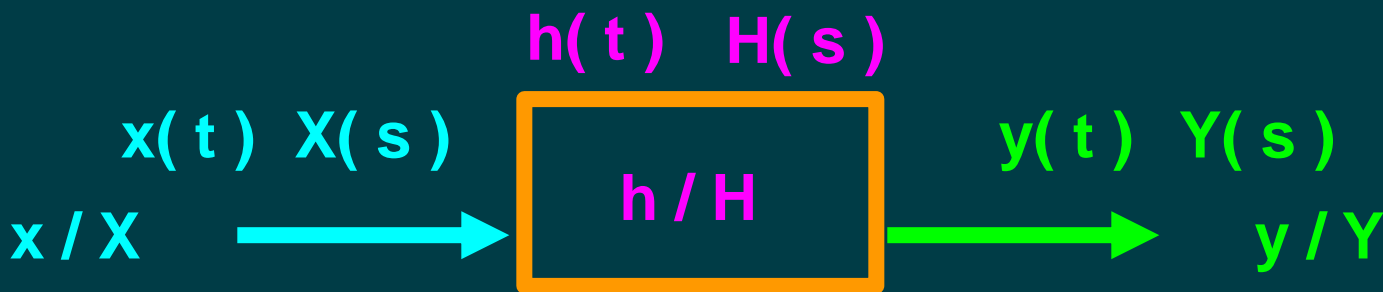
$t \in \mathbb{R}$



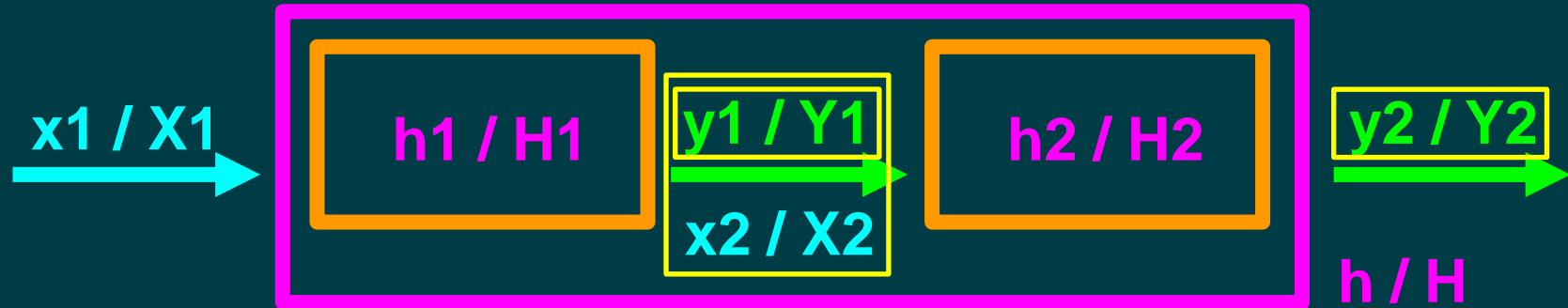
$t \in \mathbb{R}$

# 連續時間的信號與系統

連續時間



# 兩個系統的連接 – 串聯



$$Y_1 = H_1 \cdot X_1$$

$$Y_2 = H_2 \cdot X_2 = H_2 \cdot H_1 \cdot X_1$$

$$X_2 = Y_1$$

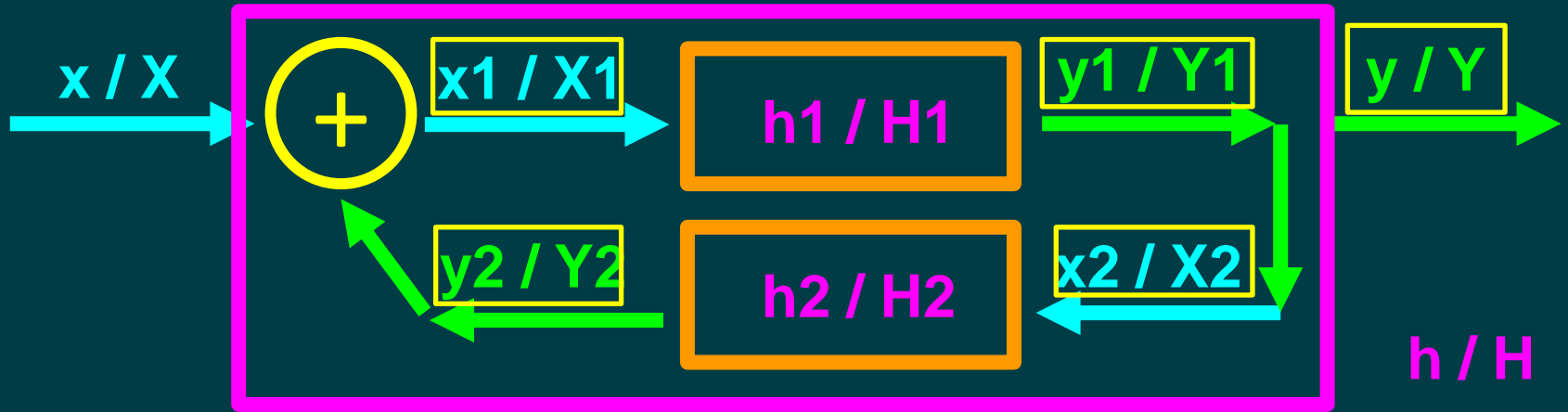
$$H = H_2 \cdot H_1$$

# 兩個系統的連接 – 並聯



$$\begin{aligned} Y_1 &= H_1 \cdot X \\ Y_2 &= H_2 \cdot X \\ Y &= Y_1 + Y_2 \\ &= H_1 \cdot X + H_2 \cdot X \\ H &= H_1 + H_2 \\ &= (H_1 + H_2) \cdot X \end{aligned}$$

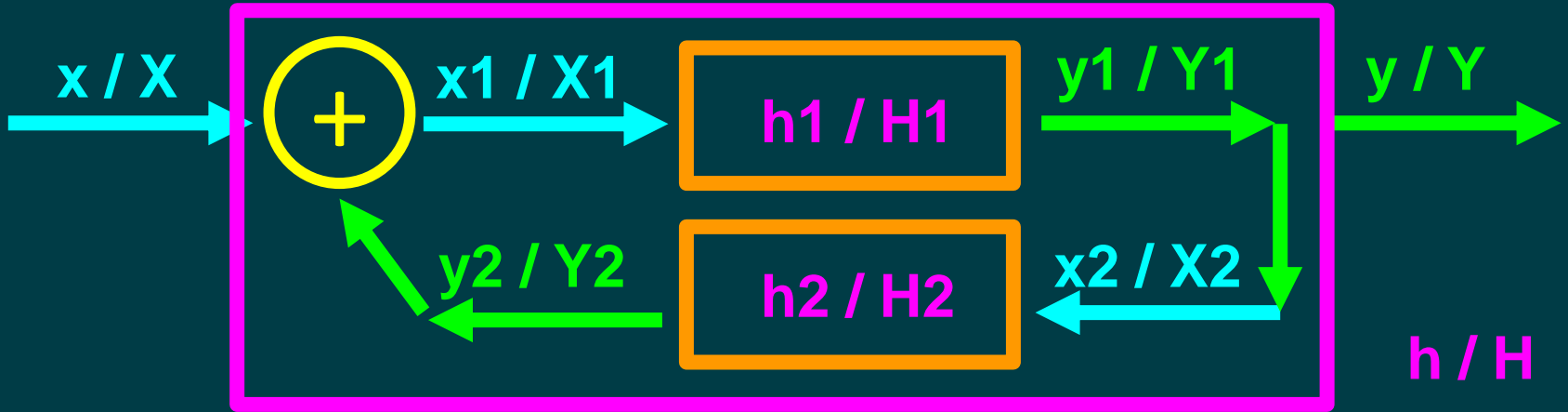
# 兩個系統的連接 – 迴授



$$\begin{aligned}
 Y &= Y1 = H1 \cdot X1 &= H1 \cdot (X + H2 \cdot Y) \\
 X1 &= X + Y2 = X + H2 \cdot Y &= H1 \cdot X + H1 \cdot H2 \cdot Y \\
 Y2 &= H2 \cdot X2 = H2 \cdot Y
 \end{aligned}$$



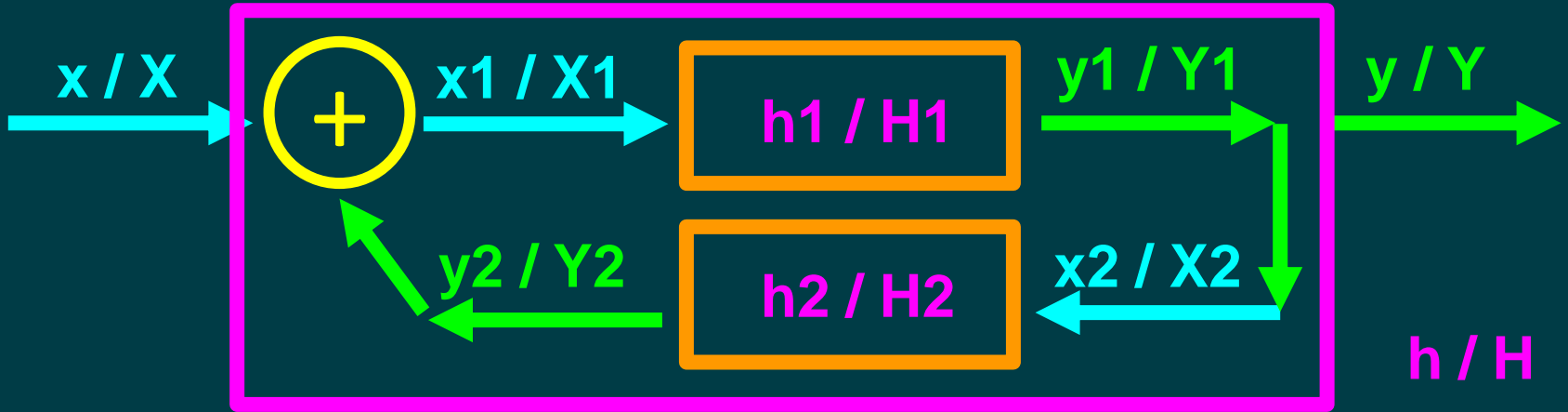
# 兩個系統的連接 – 迴授



$$\begin{aligned} \boxed{Y} &= H1 \cdot X + \boxed{H1 \cdot H2 \cdot Y} \\ \boxed{Y} - H1 \cdot H2 \cdot \boxed{Y} &= H1 \cdot X \\ Y (1 - H1 \cdot H2) &= H1 \cdot X \end{aligned}$$

$$\begin{aligned} &= H1 \cdot X + \boxed{H1 \cdot H2 \cdot Y} \\ &= H1 \cdot X \\ &= H1 \cdot X \end{aligned}$$

# 兩個系統的連接 – 迴授



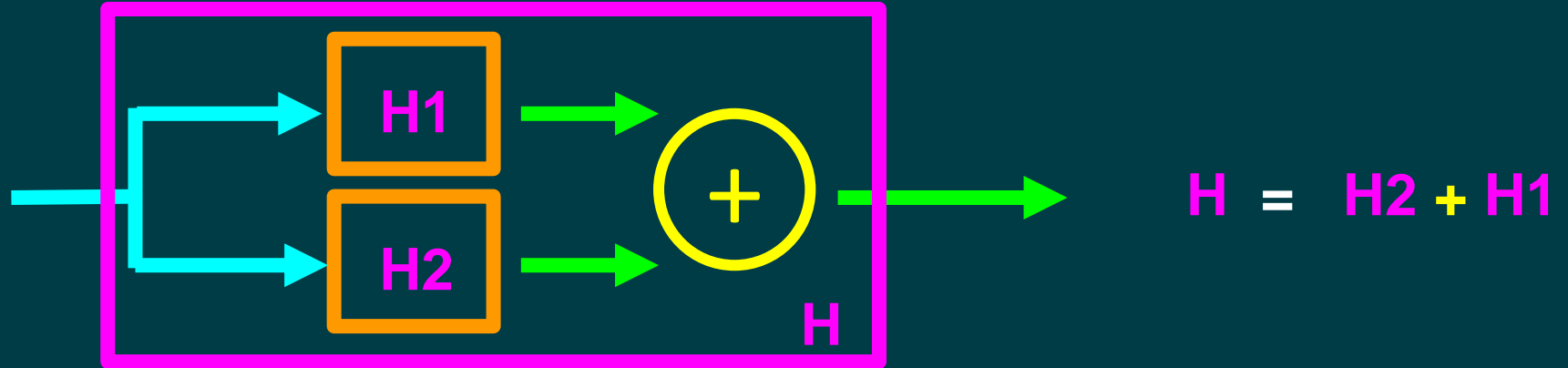
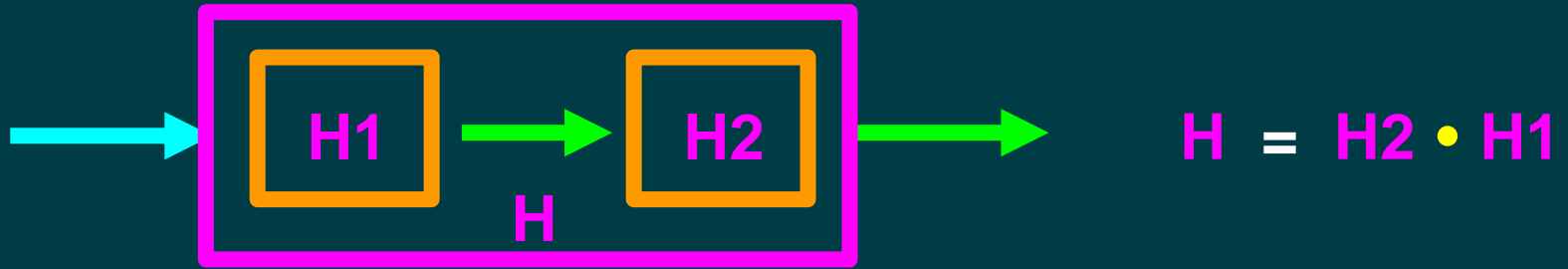
$$Y = \frac{H_1}{(1 - H_1 \cdot H_2)} \cdot X$$

$$H = \frac{H_1}{(1 - H_1 \cdot H_2)}$$

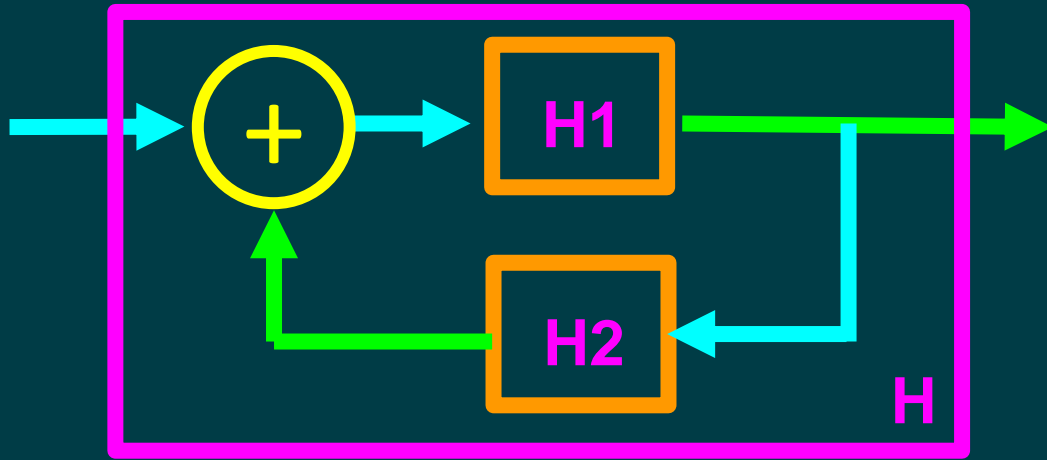
$$Y (1 - H_1 \cdot H_2)$$

$$= H_1 \cdot X$$

# 兩個系統的連接 – 串聯 並聯 迴授



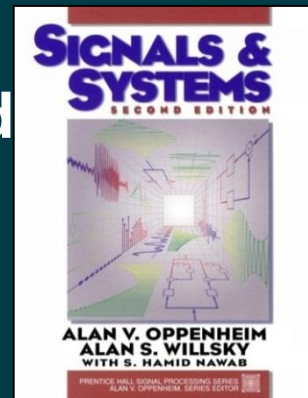
# 兩個系統的連接 – 串聯 並聯 迴授



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

# 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/>