

從信號與系統到控制

單元：CT-FT系統-4

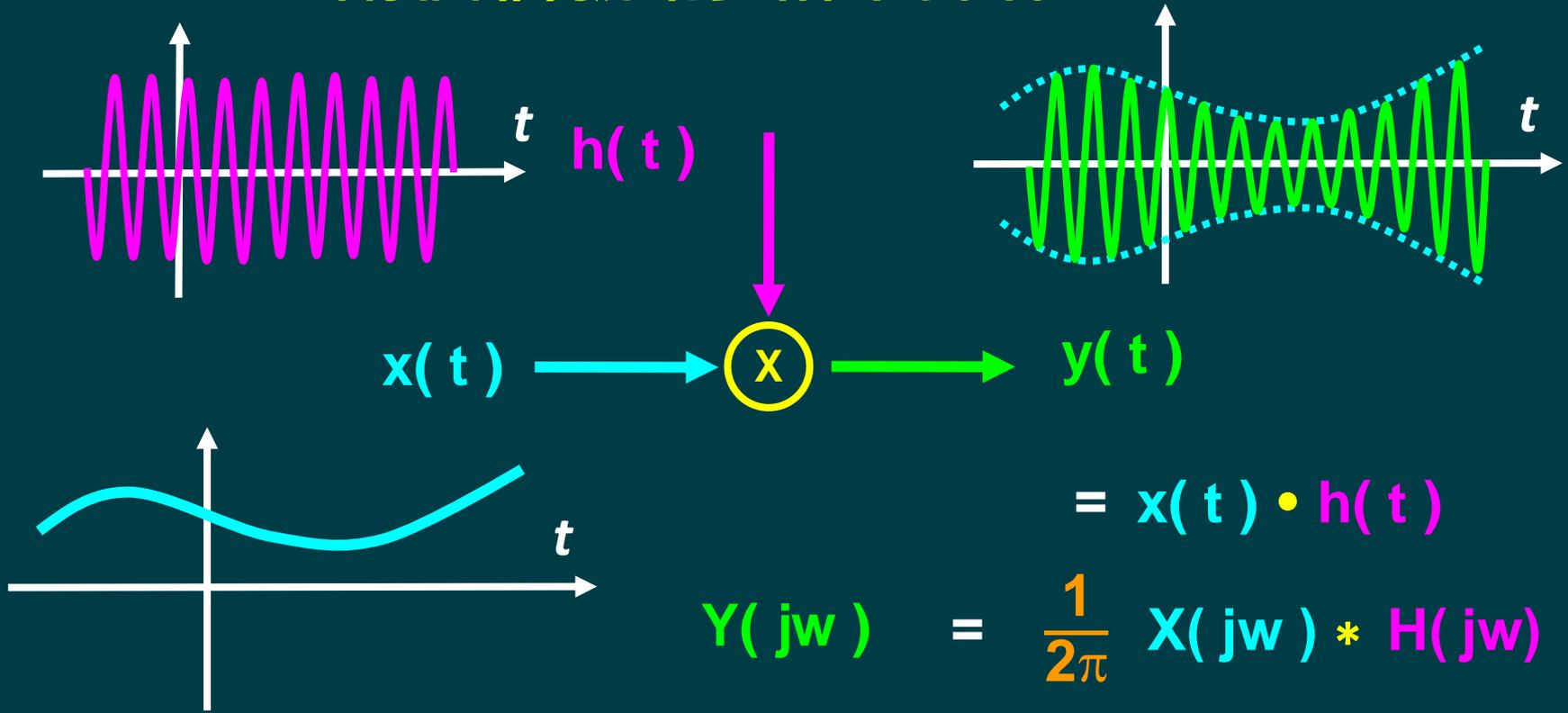
範例 - 兩個信號的相乘操作

授課老師：連 豐 力

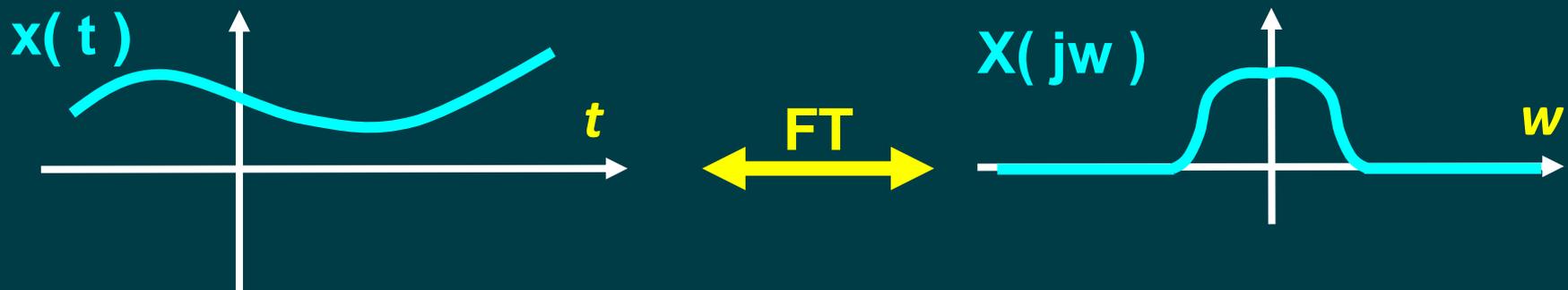
單元學習目標與大綱

- 利用 一個**範例** 瞭解
- 如何 進行 **兩個信號相乘** 的 操作
- 以及 討論 這個操作的 **系統特性**

兩個信號的相乘操作

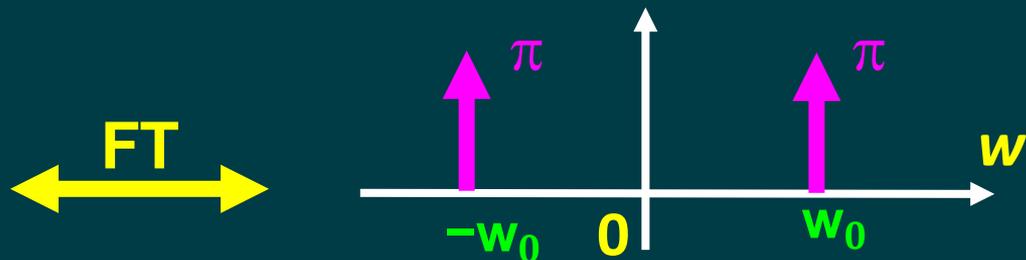
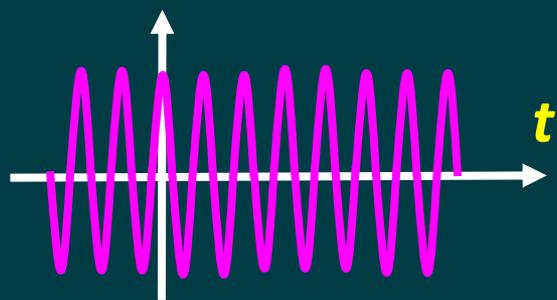


個別信號的傅立葉轉換



$$h(t) = \cos(\omega_0 t)$$

$$H(j\omega) = \pi\delta(\omega - \omega_0) + \pi\delta(\omega + \omega_0)$$



兩個信號的相乘操作

$$y(t) = x(t) \cdot h(t)$$

$$X(j\omega) \delta(\omega - k\omega_0) = X(jk\omega_0)$$

$$Y(j\omega) = \frac{1}{2\pi} X(j\omega) * H(j\omega)$$

$$= \frac{1}{2\pi} X(j\omega) * [\pi \delta(\omega - \omega_0) + \pi \delta(\omega + \omega_0)]$$

$$= \frac{\pi}{2\pi} X(j\omega) * \delta(\omega - \omega_0) + \frac{\pi}{2\pi} X(j\omega) * \delta(\omega + \omega_0)$$

$$= \frac{1}{2} X(j(\omega - \omega_0)) + \frac{1}{2} X(j(\omega + \omega_0))$$

兩個信號的相乘操作

$$y(t) = x(t) \cdot h(t)$$

$$Y(j\omega) = \frac{1}{2} X(j(\omega - \omega_0)) + \frac{1}{2} X(j(\omega + \omega_0))$$

$H(j\omega)$



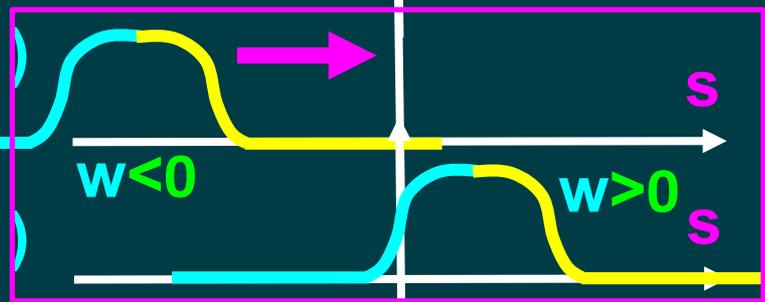
$X(j\omega)$



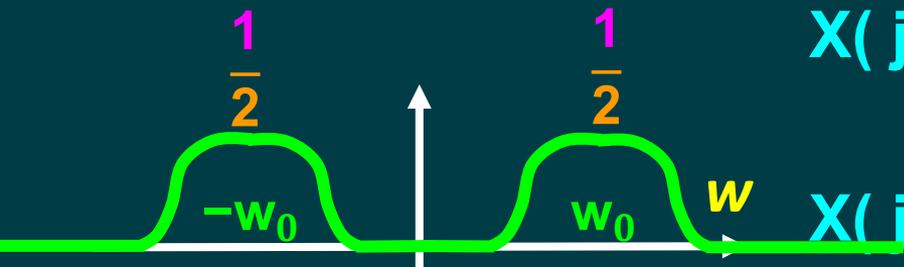
$X(-js)$



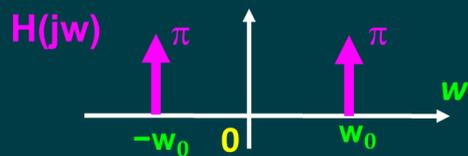
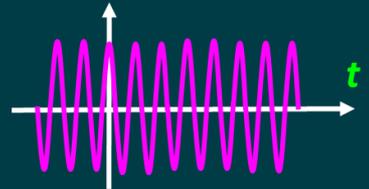
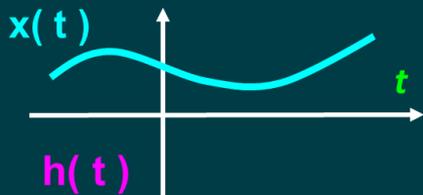
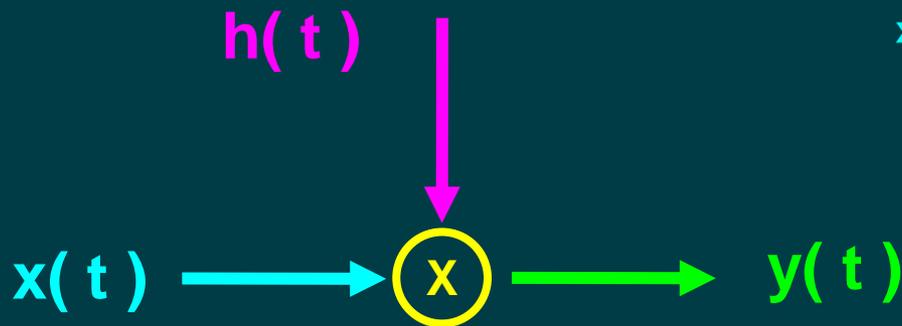
$X(j(\omega - s))$



$X(j(\omega + s))$

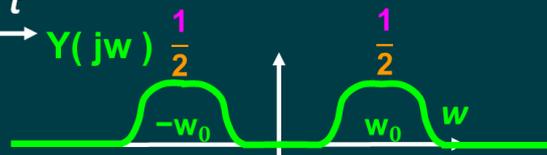
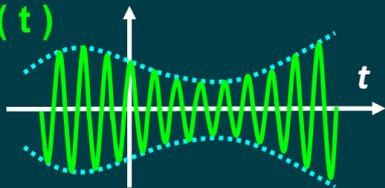


兩個信號的相乘操作



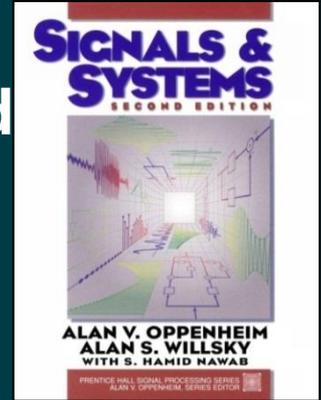
$$y(t) = x(t) \cdot h(t)$$

$$Y(jw) = \frac{1}{2\pi} X(jw) * H(jw)$$



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/>