從信號與系統到控制

單元：連續摺積-3

連續摺積計算 - 指數函數與步階函數

授課老師：連　豐　力

單元學習目標與大綱

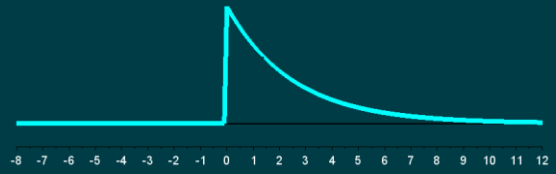
- 連續摺積計算 範例
- 指數函數 與 步階函數
- 系統 輸入輸出 的關係

連續摺積計算-指數函數與步階函數

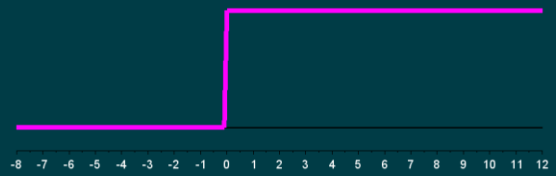
$x(t) * h(t)$

$$= \int_{-\infty}^{+\infty} x(\tau)\, h(t-\tau)\, d\tau$$

$x(t) = e^{-at}\, u(t)$



$h(t) = u(t)$

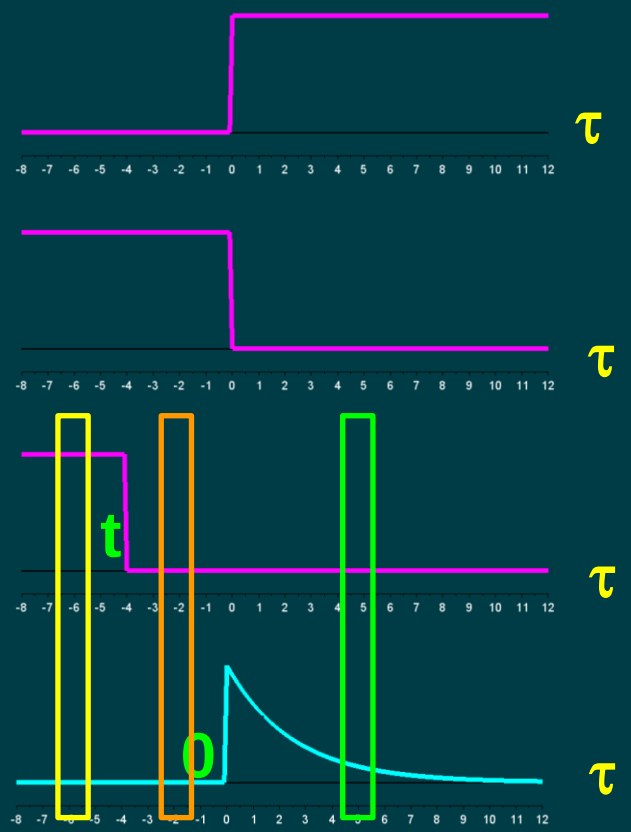


連續摺積計算

- $t < 0$

$$x(\tau)\, h(t-\tau) = 0$$

$$y(t) = \int_{-\infty}^{+\infty} x(\tau)\, h(t-\tau)\, d\tau = 0$$



連續摺積計算

- $t > 0$

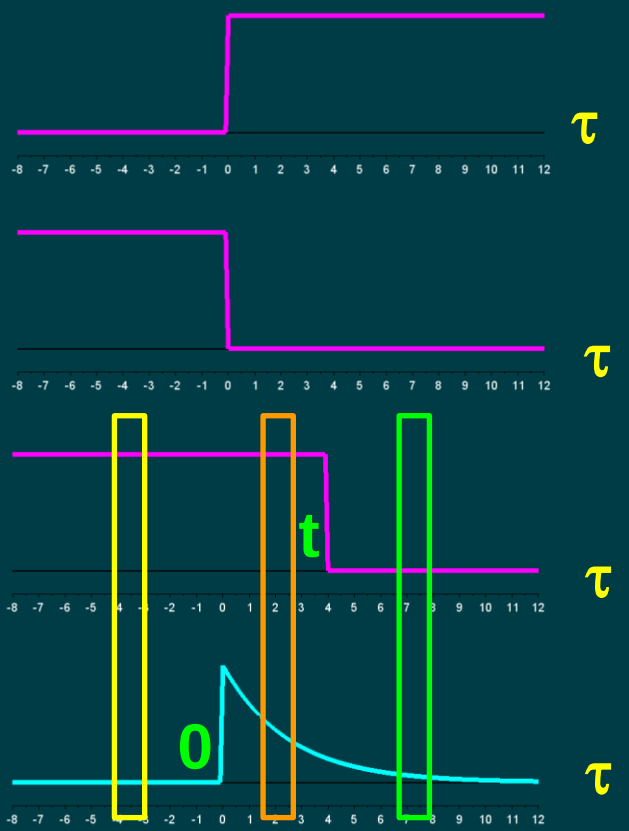
$x(\tau)\,h(t-\tau) = e^{-a\tau}$

$0 < \tau < t$

$y(t)$

$$= \int_{-\infty}^{+\infty} x(\tau)\,h(t-\tau)\,d\tau$$

$$= \int_{0}^{t} e^{-a\tau}\,d\tau = \frac{1}{a}(1-e^{-at})$$



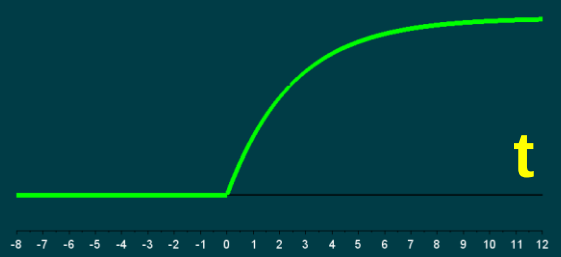
連續摺積計算

- $t < 0$

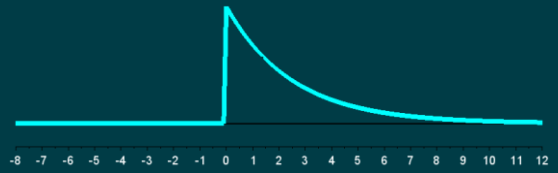
$$y(t) = 0$$

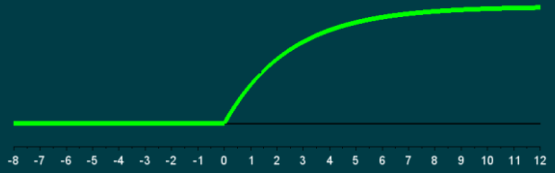
- $t > 0$

$$y(t) = \frac{1}{a}(1 - e^{-at})$$



摺積計算 與 系統輸入輸出的關係

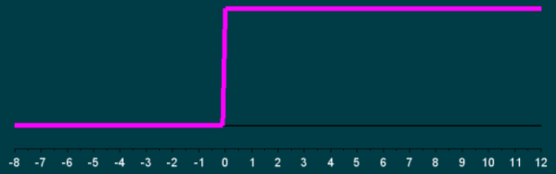




$x(t)$ → **LTI** → $y(t)$

$h(t)$

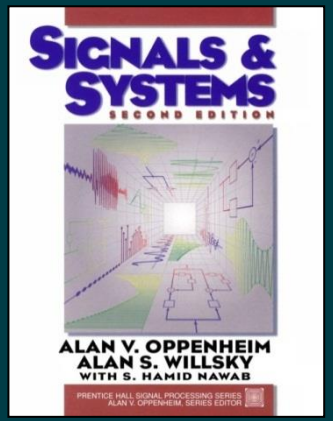
$= x(t) * h(t)$



$$= \int_{-\infty}^{+\infty} x(\tau)\, h(t-\tau)\, d\tau$$

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/