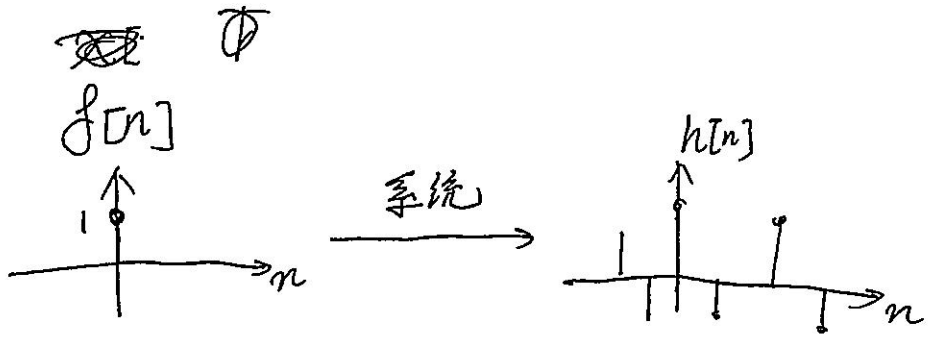
① 离散条件下卷积公式推导



$$x[n]=\sum_{k=-\infty}^{+\infty}x[k]\,\delta[n-k]$$

$$y[n]=\sum_{k=-\infty}^{+\infty}x[k]\,h[n-k]$$

因为：

$\delta[n]\longrightarrow h[n]$

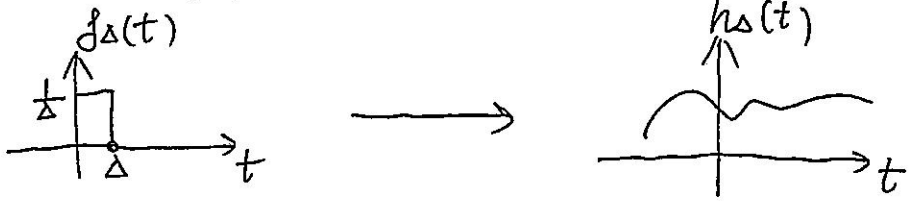
$\delta[n-k]\longrightarrow h[n-k]$ (时不变)

$x[k]\delta[n-k]\longrightarrow x[k]h[n-k]$ (线性1)

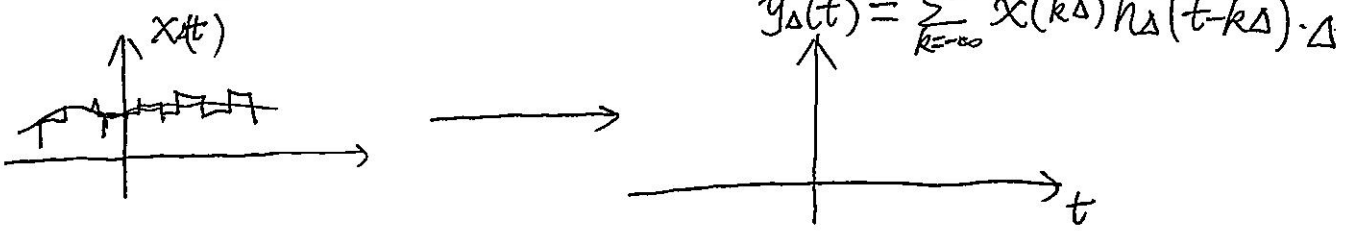
$\sum_{k=-\infty}^{+\infty}x[k]\delta[n-k]\longrightarrow\sum_{k=-\infty}^{+\infty}x[k]\,h[n-k]$ (线性2)

② 连续条件下公式推导

(a)



(b) $x_\Delta(t)=\sum_{k=-\infty}^{+\infty}x(k\Delta)\,\delta_\Delta(t-k\Delta)\cdot\Delta$



$$y_\Delta(t)=\sum_{k=-\infty}^{+\infty}x(k\Delta)\,h_\Delta(t-k\Delta)\cdot\Delta$$

(c) $x(t)=\lim_{\Delta\to0}x_\Delta(t)\longrightarrow y(t)=\lim_{\Delta\to0}y_\Delta(t)=\int_{-\infty}^{+\infty}x(u)h(t-u)du$