

## Aliasing & Reconstruction

DSP Course

Instructor: Chun-Tang Chao (趙春棠)

◇  $x(t) = \cos(2\pi \times 100t)$       **【f=100 Hz】**

經取樣 ( $T_s$ ) 後的  $x[n] = x(nT_s) = \cos(2\pi \times 100 \times nT_s)$  頻譜及還原後的訊號如下：

<b><math>T_s = 0.0125</math> (<math>f_s = 80\text{Hz}</math>) Aliasing!</b>	<b><math>T_s = 0.01</math> (<math>f_s = f = 100\text{Hz}</math>) Aliasing!</b>
<p style="text-align: center;">Spectrum of the 100 Hz Cosine Wave</p> <p style="text-align: center;">Magnitude vs Analog Frequency (Hz)</p> <p style="text-align: center;">Sampled at <math>T_s = 12.5</math> msec (<math>f_s = 80</math> Hz)</p> <p style="text-align: center;">Discrete-Time Spectrum of the 100 Hz Sinusoid</p> <p style="text-align: center;">Magnitude vs Frequency (<math>\omega</math>)</p> <p>1. <math>x[n] = x(nT_s) = \cos(2.5\pi n) = \cos(0.5\pi n)</math></p> <p>2. 還原訊號頻率：20 Hz</p>	<p style="text-align: center;">Spectrum of the 100 Hz Cosine Wave</p> <p style="text-align: center;">Magnitude vs Analog Frequency (Hz)</p> <p style="text-align: center;">Sampled at <math>T_s = 10</math> msec (<math>f_s = 100</math> Hz)</p> <p style="text-align: center;">Discrete-Time Spectrum of the 100 Hz Sinusoid</p> <p style="text-align: center;">Magnitude vs Frequency (<math>\omega</math>)</p> <p>1. <math>x[n] = x(nT_s) = \cos(2\pi n) = \cos(0\pi n)</math></p> <p>2. 還原訊號頻率：0 Hz</p>
<b><math>T_s = 0.008</math> (<math>f_s = 125\text{Hz}</math>) Aliasing!</b>	<b><math>T_s = 0.002</math> (<math>f_s = 500\text{Hz}</math>)</b>
<p style="text-align: center;">Spectrum of the 100 Hz Cosine Wave</p> <p style="text-align: center;">Magnitude vs Analog Frequency (Hz)</p> <p style="text-align: center;">Sampled at <math>T_s = 8</math> msec (<math>f_s = 125</math> Hz)</p> <p style="text-align: center;">Discrete-Time Spectrum of the 100 Hz Sinusoid</p> <p style="text-align: center;">Magnitude vs Frequency (<math>\omega</math>)</p> <p>1. <math>x[n] = x(nT_s) = \cos(1.6\pi n) = \cos(\pm 0.4\pi n)</math></p> <p>2. 還原訊號頻率：25 Hz</p>	<p style="text-align: center;">Spectrum of the 100 Hz Cosine Wave</p> <p style="text-align: center;">Magnitude vs Analog Frequency (Hz)</p> <p style="text-align: center;">Sampled at <math>T_s = 2</math> msec (<math>f_s = 500</math> Hz)</p> <p style="text-align: center;">Discrete-Time Spectrum of the 100 Hz Sinusoid</p> <p style="text-align: center;">Magnitude vs Frequency (<math>\omega</math>)</p> <p>1. <math>x[n] = x(nT_s) = \cos(0.4\pi n)</math></p> <p>2. 還原訊號頻率：100 Hz <b>【與原訊號同！】</b></p>