李塞爾氏圖形(Lissajous pattern)

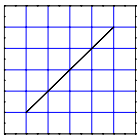
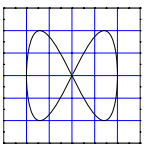
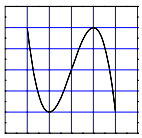
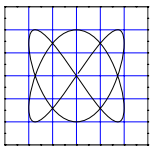
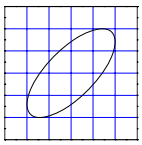
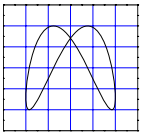
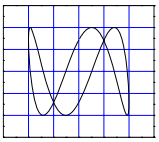
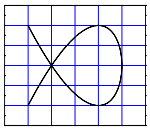
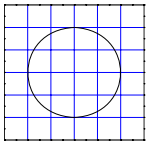
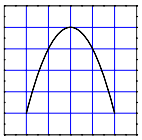
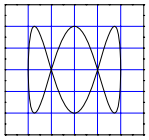
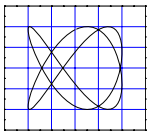
所謂 Lissajous pattern 是將一個已知頻率和一個未知頻率的信號，分別輸入示波器的 X 軸與 Y 軸產生出來的某些特別的圖形。當已知頻率與未知頻率比為整數時，圖形會穩定呈現在螢幕上，可由圖形判別未知訊號的頻率與相位差。

例如： $x(t)=A\ \sin(\omega_x t+\phi_x)$ ；$y(t)=A\ \sin(\omega_y t+\phi_y)$

欲使螢光幕產生穩定且封閉軌跡之圖形的條件為：

$$\frac{\omega_x}{\omega_y}=\frac{f_x}{f_y}=\frac{n_y}{n_x}$$ n 是大於零之整數

不同比值顯現不同圖形，諸如下表：$\phi=(\phi_y-\phi_x)$

ϕ	$\frac{f_y}{f_x}=\frac{1}{1}$	ϕ	$\frac{f_y}{f_x}=\frac{2}{1}$	ϕ	$\frac{f_y}{f_x}=\frac{3}{1}$	ϕ	$\frac{f_y}{f_x}=\frac{3}{2}$
$0,$ 2π		$0,$ $\pi,$ 2π		$0,$ 2π		$0,$ $\frac{\pi}{2},$ $\frac{3\pi}{2},$ 2π	
$\frac{\pi}{4},$ $\frac{7\pi}{4}$		$\frac{\pi}{4},$ $\frac{3\pi}{4}$		$\frac{\pi}{4},$ $\frac{7\pi}{4}$		$\frac{\pi}{4},$ $\frac{5\pi}{4}$	
$\frac{\pi}{2},$ $\frac{3\pi}{2}$		$\frac{\pi}{2}$		$\frac{\pi}{2},$ $\frac{3\pi}{2}$		$\frac{3\pi}{8},$ $\frac{11\pi}{8}$	

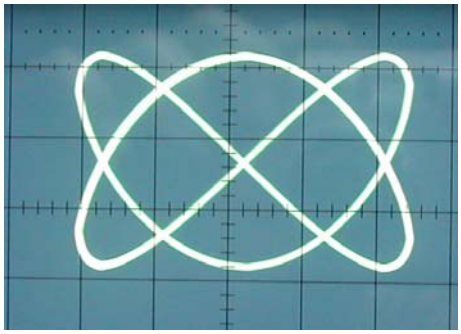
1.判別未知訊號的頻率

☆未知頻率[Hz]=$\frac{P_h}{P_v}$×訊號產生器訊號的頻率

P_h:圖形與水平軸交點的數目

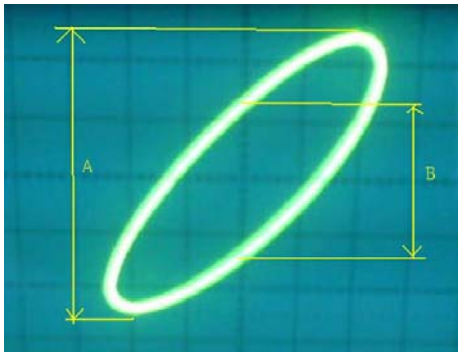
P_v:圖形與垂直軸交點的數目

如右圖 $\frac{f_y}{f_x}=\frac{6}{4}$



2.判別未知訊號的相位差

1.利用 Lissajou’s 圖形相位差



相位差 $\theta = \sin^{-1}\frac{B}{A}$

[註:圖形的中心需調至與座標中心重合]

2.利用雙訊號

按下 DU AL 按鈕使兩個訊號呈現。

量度兩訊號相鄰兩波峰(或谷)的水平間隔 t 及其中一個訊號之兩相鄰波峰的水平間隔 T(及週期)。

則 相位差 θ [弧度角] $= \frac{t}{T} \times 2\pi$

θ [度] $= \frac{t}{T} \times 360^{\circ}$