苏泓源 2019010448 统计信号 HW3

$$x(t) = 1-\cos\omega_0 t \qquad t\in[0, 2\pi/\omega_0]$$

$$S(j\omega) = \int_{-\infty}^{+\infty} x(t)e^{-j\omega t}dt$$

$$= \frac{2\pi\omega_0}{\omega_0^2-\omega^2}\operatorname{sinc}\left(\frac{\omega}{\omega_0}\right)e^{-j\pi\frac{\omega}{\omega_0}}$$

匹配滤波器:

$$H(j\omega) = \frac{KS^*(j\omega)}{\Phi_n(\omega)}e^{-j\omega t_0}$$

$$= K\cdot\frac{2\pi\omega_0(\omega^2+\omega_1^2)}{\omega_1^2(\omega_0^2-\omega^2)}\operatorname{sinc}\left(\frac{\omega}{\omega_0}\right)e^{-j\omega(t_0-\frac{\pi}{\omega_0})}$$

$$\Phi_n(\omega) = \frac{\omega_1^2}{\omega^2+\omega_1^2} = \frac{(j\omega_1)^2}{(j\omega+\omega_1)(j\omega-\omega_1)} = G_n^+(\omega)G_n^-(\omega)$$

最大信噪比

$$\left(\frac{|S_o(t_0)|^2}{\overline{n_o^2(t)}}\right)_{max} = \frac{1}{2\pi}\int_{-\infty}^{+\infty}\left|\frac{S(j\omega)}{G_n^-(\omega)}\right|^2 d\omega$$

$$= \frac{1}{2\pi}\int_{-\infty}^{+\infty}\left(1+\frac{\omega^2}{\omega_1^2}\right)|S(j\omega)|^2 d\omega$$

$$= \frac{3\pi}{\omega_0}+\frac{\pi\omega_0}{\omega_1^2}$$