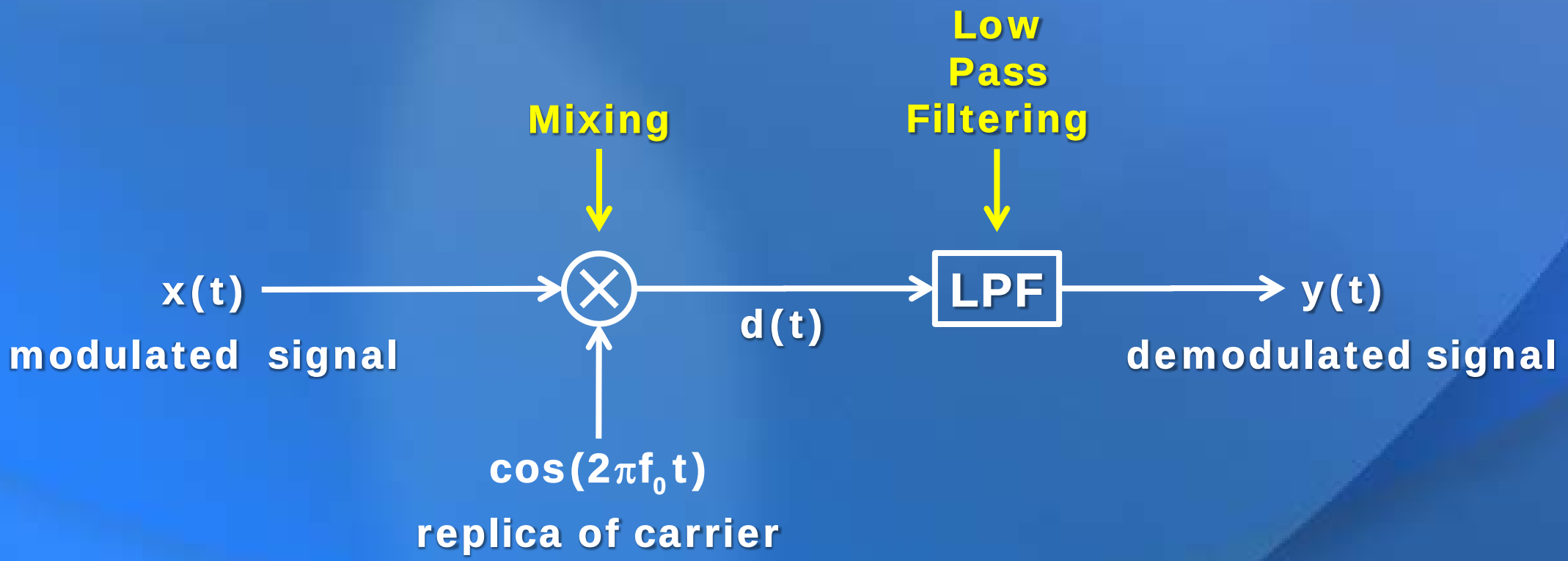
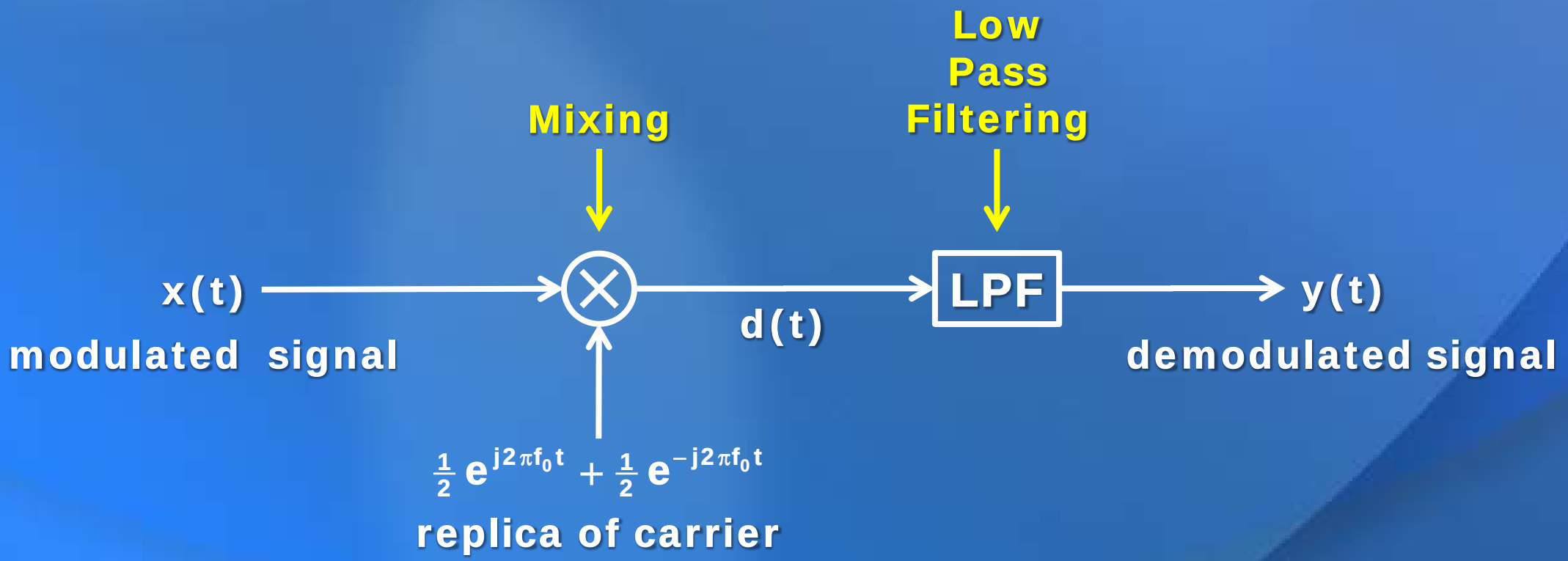
Analysis of Mixing using Complex Exponentials

Demodulation

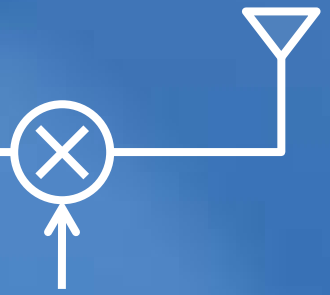


Demodulation

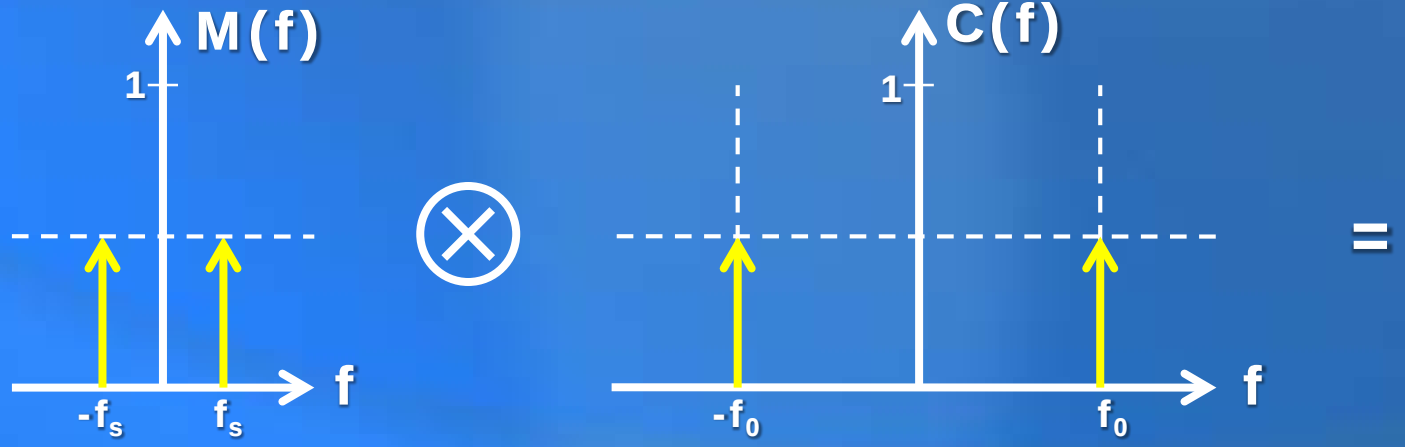


Modulation

$$m(t) = \frac{1}{2} e^{j2\pi f_s t} + \frac{1}{2} e^{-j2\pi f_s t}$$



$$c(t) = \frac{1}{2} e^{j2\pi f_0 t} + \frac{1}{2} e^{-j2\pi f_0 t}$$



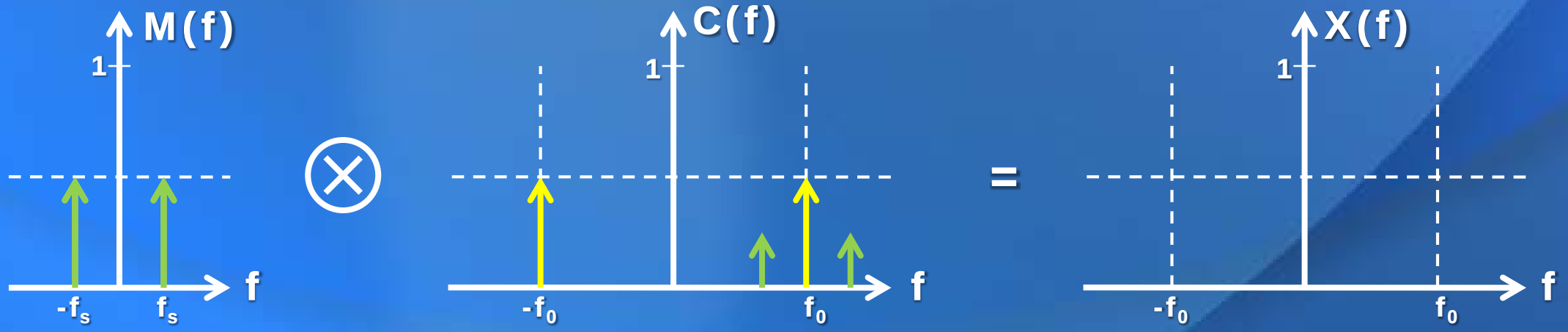
Modulation

$$m(t) = \frac{1}{2} e^{j2\pi f_s t} + \frac{1}{2} e^{-j2\pi f_s t}$$

$$c(t) = \frac{1}{2} e^{j2\pi f_0 t} + \frac{1}{2} e^{-j2\pi f_0 t}$$

$$x(t) = \left(\frac{1}{2} e^{j2\pi f_s t} + \frac{1}{2} e^{-j2\pi f_s t}\right)\left(\frac{1}{2} e^{j2\pi f_0 t} + \frac{1}{2} e^{-j2\pi f_0 t}\right)$$

$$= \frac{1}{4} e^{j2\pi(f_0+f_s)t} + \frac{1}{4} e^{j2\pi(f_0-f_s)t}$$



Modulation

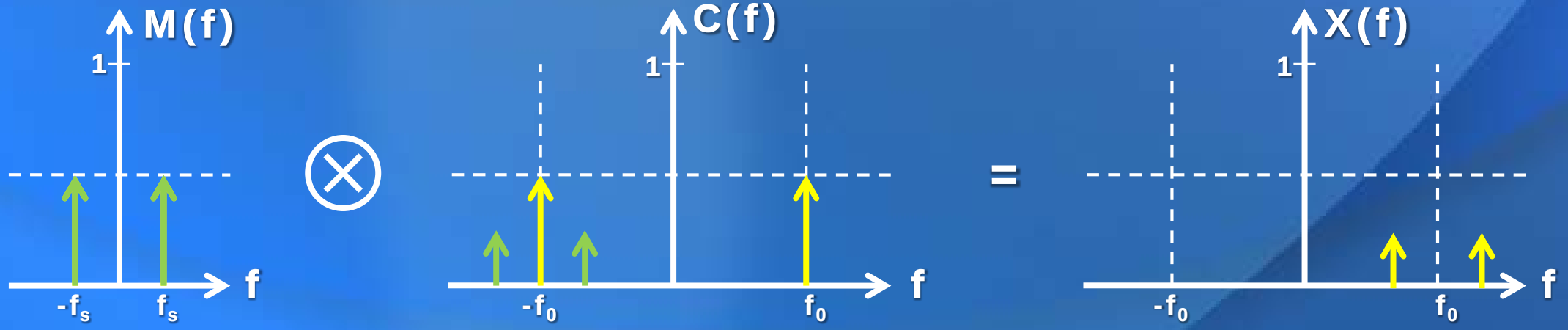
$$m(t) = \frac{1}{2} e^{j2\pi f_s t} + \frac{1}{2} e^{-j2\pi f_s t}$$

$$c(t) = \frac{1}{2} e^{j2\pi f_0 t} + \frac{1}{2} e^{-j2\pi f_0 t}$$

$$x(t) = \left(\frac{1}{2} e^{j2\pi f_s t} + \frac{1}{2} e^{-j2\pi f_s t}\right)\left(\frac{1}{2} e^{j2\pi f_0 t} + \frac{1}{2} e^{-j2\pi f_0 t}\right)$$

$$= \frac{1}{4} e^{j2\pi(f_0+f_s)t} + \frac{1}{4} e^{j2\pi(f_0-f_s)t}$$

$$+ \frac{1}{4} e^{j2\pi(-f_0+f_s)t} + \frac{1}{4} e^{j2\pi(-f_0-f_s)t}$$



Modulation

$$m(t) = \frac{1}{2} e^{j2\pi f_s t} + \frac{1}{2} e^{-j2\pi f_s t}$$

$$c(t) = \frac{1}{2} e^{j2\pi f_0 t} + \frac{1}{2} e^{-j2\pi f_0 t}$$

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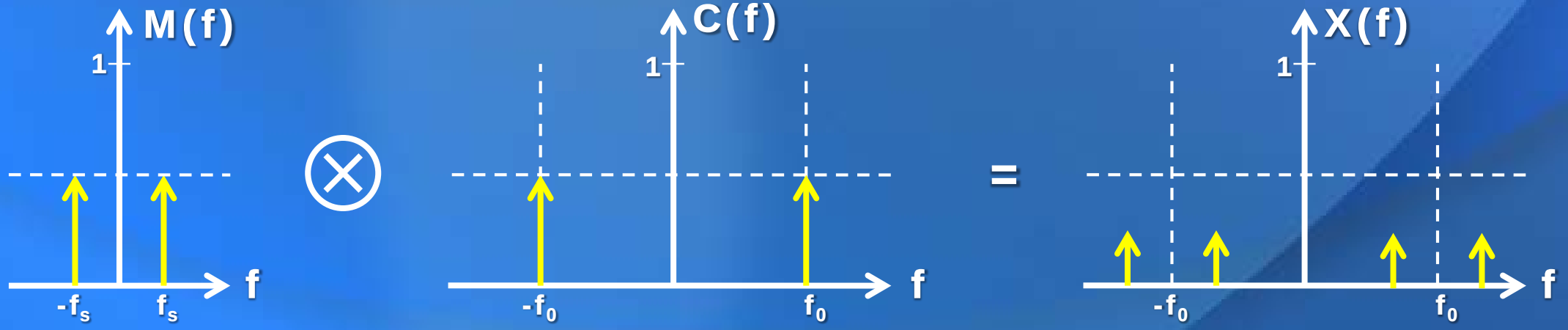
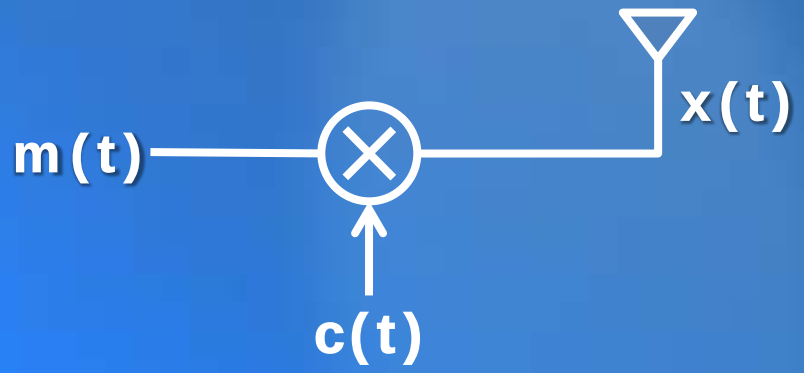
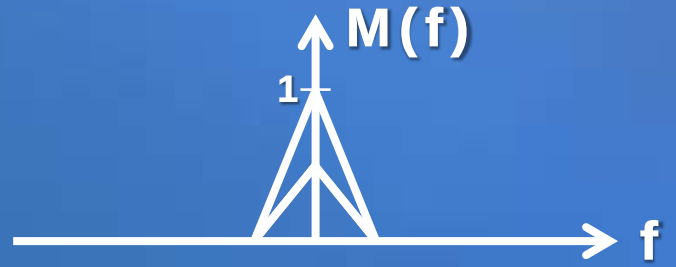
$$= \frac{1}{4} e^{j2\pi(f_0+f_s)t} + \frac{1}{4} e^{j2\pi(f_0-f_s)t}$$

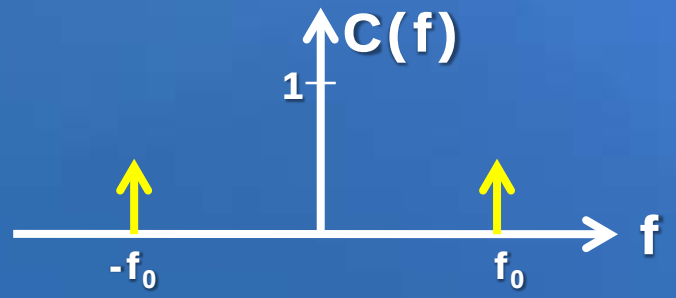
$$+ \frac{1}{4} e^{j2\pi(-f_0+f_s)t} + \frac{1}{4} e^{j2\pi(-f_0-f_s)t}$$

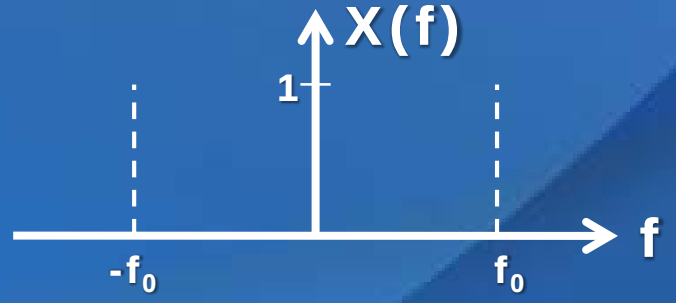


Pictorial Analysis

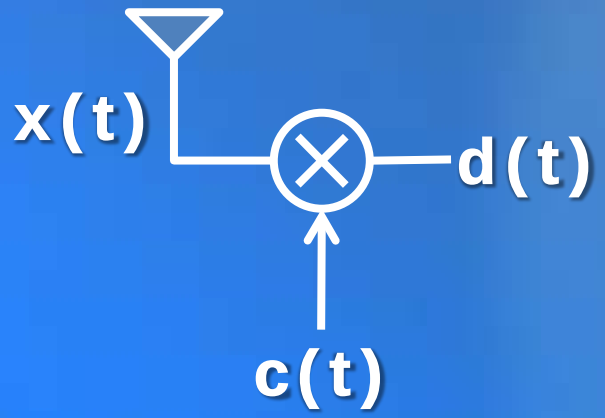


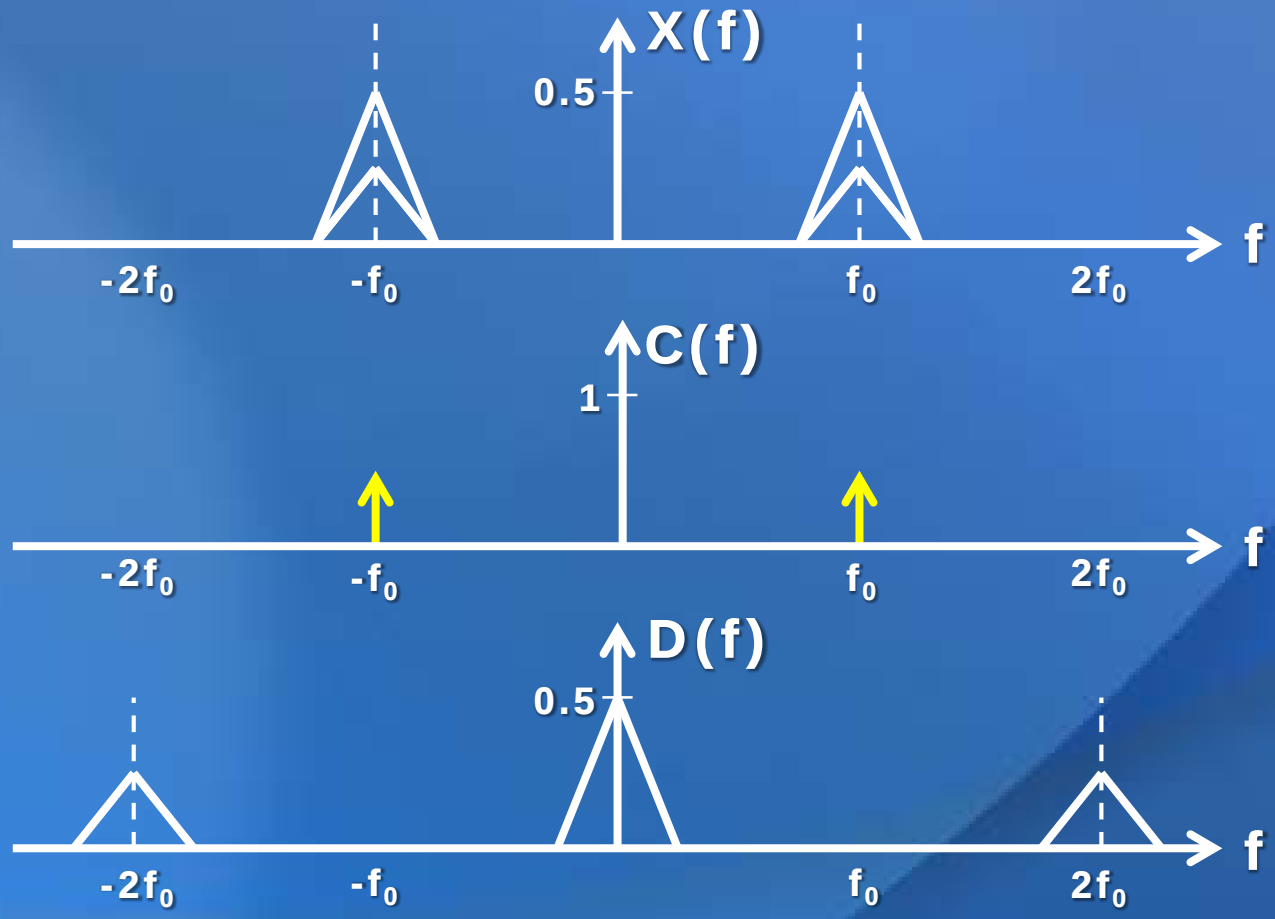






Mixing in Demodulation





Modulation / Mixing