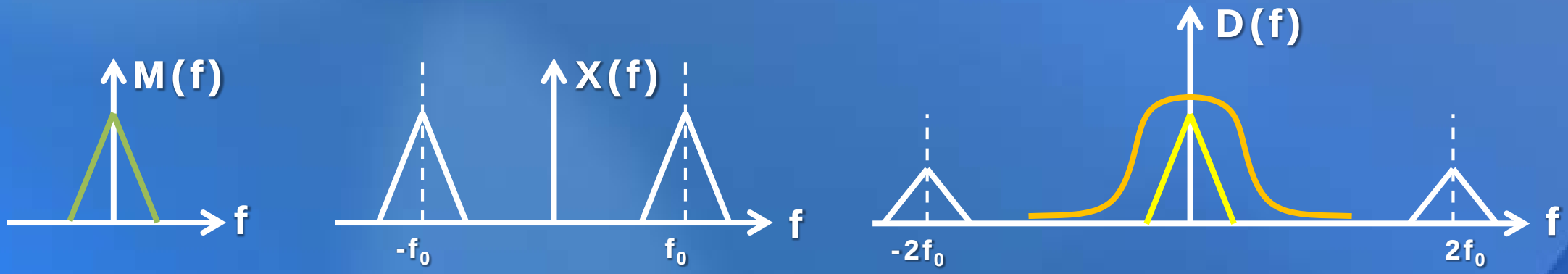
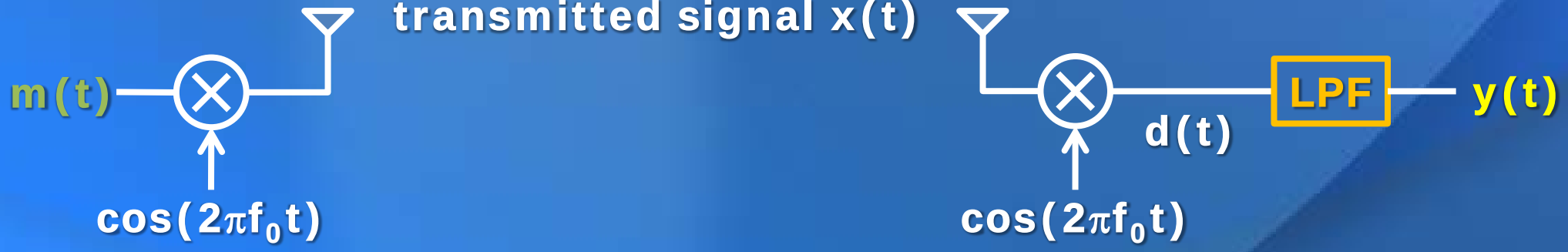
Non-ideal Effects

Transmitter / Receiver Pair

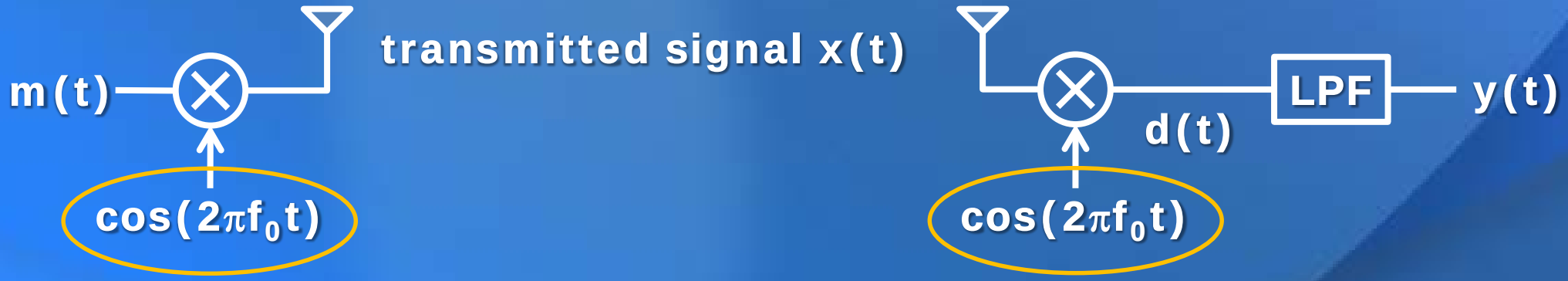




Key Assumption

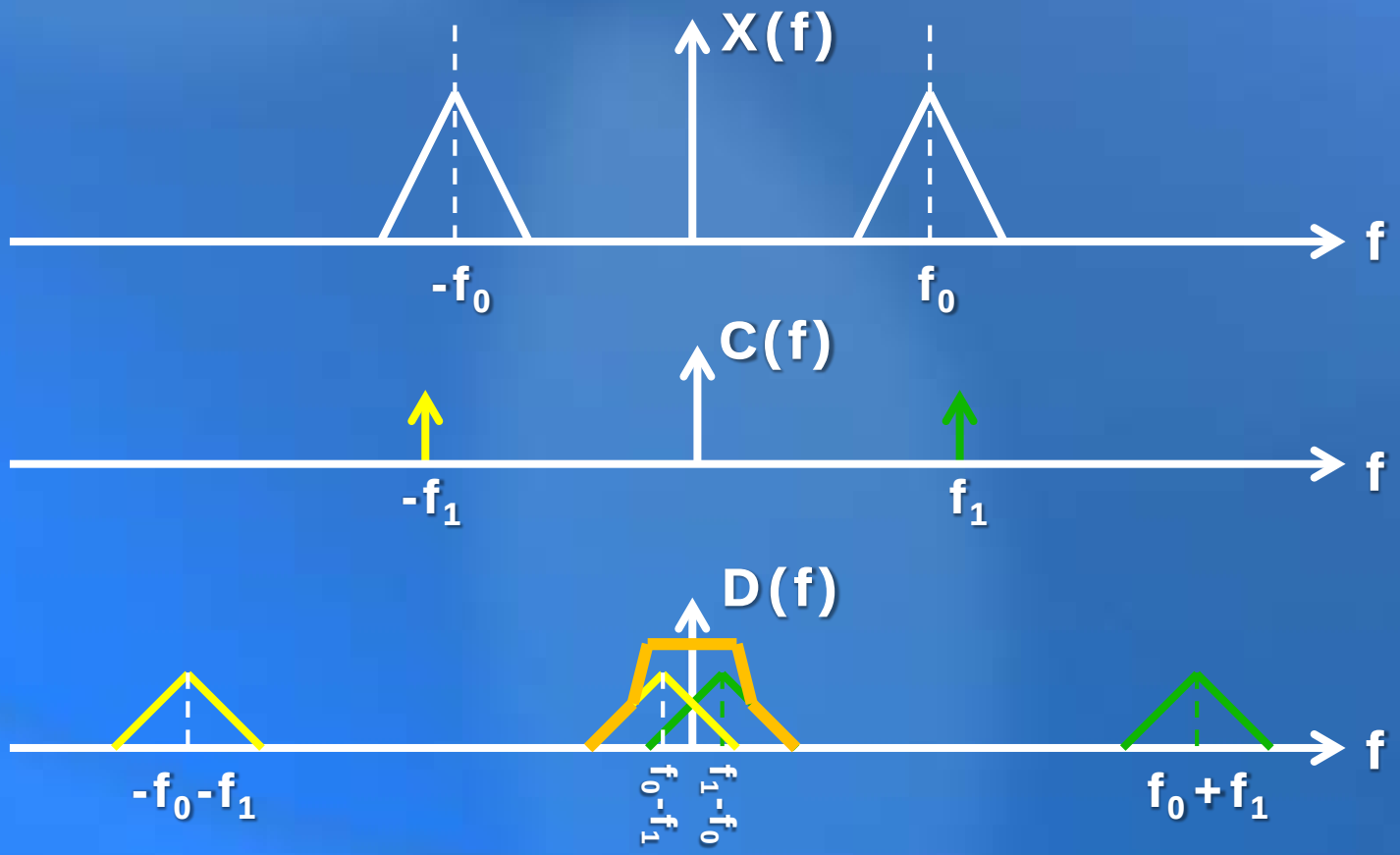
Our analysis has assumed that the cosines used in the mixers of the transmitter and receiver are exactly matched

- They have exactly the same frequency.
- They have exactly the same phase.

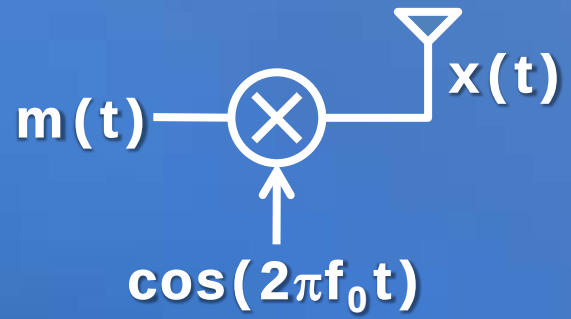


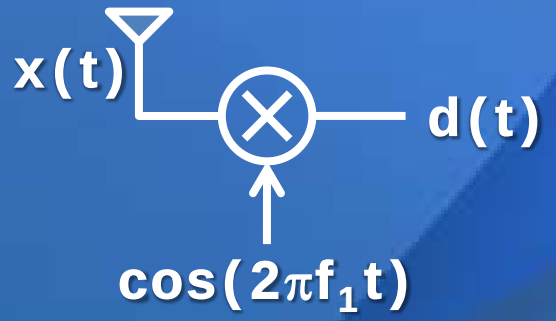
What if this is not true?

Frequency Offset



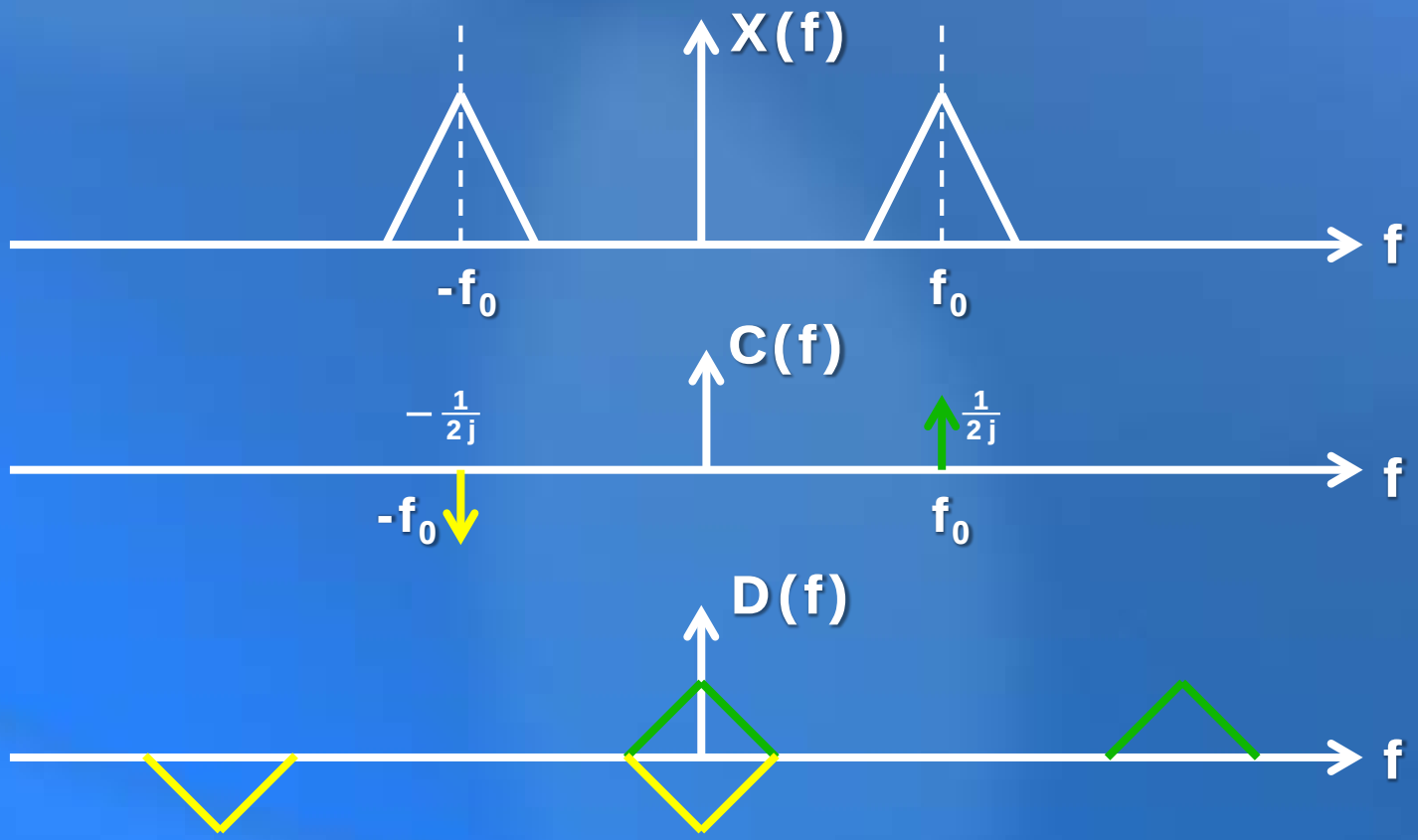
baseband signal is corrupted!

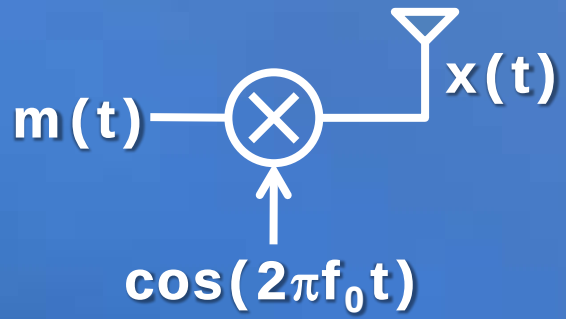


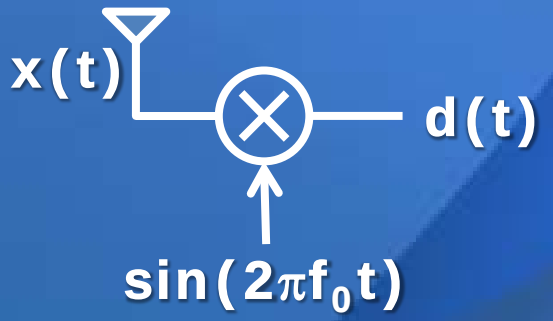


This cannot be fixed by filtering!

90 Degree Phase Shift







$$\frac{1}{2j} e^{j2\pi f_0 t} - \frac{1}{2j} e^{-j2\pi f_0 t}$$

baseband signal disappears!

Coherent modulation/demodulation

When transmitter and receiver local oscillators are 90 degree offset in phase:

- Demodulated signal destructively adds at baseband.
- We suddenly receive no baseband signal!

We need to synchronize the phase local oscillators creating the carrier frequency cosines at the transmitter and receiver

- The phases must be the same (i.e. both cosines or both sines).
- This is known as coherent modulation/demodulation
- This phenomenon can be exploited to double transmission capacity using I-Q modulation.