HETERODYNE AND IMAGE-REJECT RECEIVER

Simple Heterodyne Receiver

+ The IF filter suppresses out-of-channel interferers, thus performing channel selection.

- A key issue in heterodyning is the tradeoff between image rejection and adjacent channel suppression.

- IF filter is an off-chip filter that must match SO2.

- For given filter quality factors (Qs) and losses, if the IF is high:
  - Image is greatly attenuated whereas nearby interferers remain large.
  - If the IF is low, image corrupts the downconverted signal.

But

INTERFERER

DESIGNED CHANNEL

IMAGE

INTERFERER

CHANNEL SELECT FILTER

\[
\begin{align*}
\cos \angle \text{IF} &= 1
\end{align*}
\]
IMAGE-REJECT ARCHITECTURES

They allow to split the desired signal with the same polarity and the image with opposite polarities. Thus the sum of these two signals is free from the image.

HARTLEY

WEAVER IIP ARCHITECTURE

- Gain and Phase Mismatch Problems.
NOTES ON ARCHITECTURES OF RECEIVERS

LO(0) - IF SINGLE CONVERSION

INDIRECT CONVERSION TO ZERO IF
(DIRECT CONVERSION DROPS FIRST MIXER)

DUAL CONVERSION WITH LOW SECOND IF AND ON-CHIP IMAGE REJECTION
ZERO IF TOPOLOGY

- Desired channel is selected by a LP filter.

- Trouble with baseband flicker noise and DC offsets.
  The offsets in an IC receiver might be two orders of magnitude higher than the signal.
  No IR filter is needed.
  FSK modulation is tolerant to DC offsets, which might be removed by a capacitor output.

- \( \omega_0 \) is needed because the two sidebands of the RF spectrum in a typical phase and frequency modulated signals contain different information.

- \( I \) and \( Q \) are needed because the two sidebands of the RF spectrum in a typical phase and frequency modulated signals contain different information.