Feedback (Neg.) Stability

$A_F(s) = \frac{A(s)}{1 + A(s)B(s)} = \frac{A(s)}{1 + (-1)^N}$

$|A(s)B(s)| \, dB$

Trouble or an oscillator

Op Amp Buffer -

Phase margin is crucial to achieving fast responses with sufficient accuracy.

Phase Margin is Tauc delay
OSCILLATORS

Intro-
Oscillators use some form of positive feedback to create a periodic waveform.

Classifications-
Tuned - Sinusoidal
Untuned - Square wave

Criteria for Oscillation
1) \( \text{Loop gain} = 1+j0 \) or \( 1\angle 0^\circ \)
2) Determinant \( A = 0 \)

Wien Bridge Oscillator

\[
T(s) = \frac{A(s)}{B(s)} = K \times \frac{\frac{R}{sC}}{\frac{R}{sC} + \frac{K}{sC}}
\]

\[
T(s) = \frac{K \left( \frac{1}{sRC} \right)}{\left( \frac{1}{sRC} + 1 \right)}
\]

\[
T(s) = \frac{sKR}{s^2R^2 + s2RC + 5RC}
\]

\[
T(j\omega) = \frac{j\omega KR}{1 - \omega^2 R^2 + j\omega 3RC} = 1 + j0 \quad \omega \text{ in rad/s}
\]

\[
K = 3 \quad R = 100k \quad C = 1\mu F \quad \frac{1}{2C} = \frac{1}{105.10^{-6}} = 10
\]
Amplitude Stabilization of an Oscillator

The amplitude of the oscillator stabilizes at a value which cause the "effective" loop gain to be unity.

K amplifier -

\[ \frac{N_0}{N_x} = \frac{R_1 + R_2 + R_3}{R_1} = 3.2 \]

Diodes off:

Diodes on:

\[ \frac{N_0}{N_x} = \frac{R_1 + R_2 + R_3}{R_1} = 2.8 \]

\[ \text{Slope} < 3 \]

\[ \text{Slope} > 3 \]
LC Oscillator

1.) Colpitts

\[ \omega_{osc} = \frac{1}{\sqrt{L \left( \frac{G_m C_2}{C_1 + C_2} \right)}} \]
\[ G_m R_0 = \frac{C_2}{C_1} \]

2.) Hartley

\[ \omega_{osc} = \frac{1}{\sqrt{C (L_1 + L_2)}} \]
\[ G_m R_0 = \frac{L_1}{L_2} \]

Example