Oscillators

INEL 4202 Fall 2009
If the loop gain $L = A(\omega)\beta(\omega)$ is real and larger than one at a frequency $\omega_0$, the circuit will produce a sinusoidal output voltage with frequency $\omega_0$. 
\[
\frac{v_f}{v_i} = A(\omega_0)\beta(\omega_0) = M(\omega_0)\angle\phi(\omega_0) = +1
\]

This means that the magnitude \( M(\omega_0) \) must be unity and the phase angle \( \angle\phi(\omega_0) = 0^\circ \).

Strategy:

- find loop gain \( L = A(\omega)\beta(\omega) \)
- find frequency \( \omega_0 \) at which the loop gain is real; the imaginary part is zero
- determine the amplifier gain required to make the loop gain larger than 1
- the criterion must be satisfied at a single, well defined \( \omega_0 \)
- the amplifier gain \( A \) will depend on the input impedance of the feedback network. unless the amplifier’s output impedance is zero (i.e. op amps)
Phase-shift oscillator
Wein-Bridge Oscillator
LC Oscillators: Colpitts Oscillator

Colpitts Oscillator

Equivalent Circuit