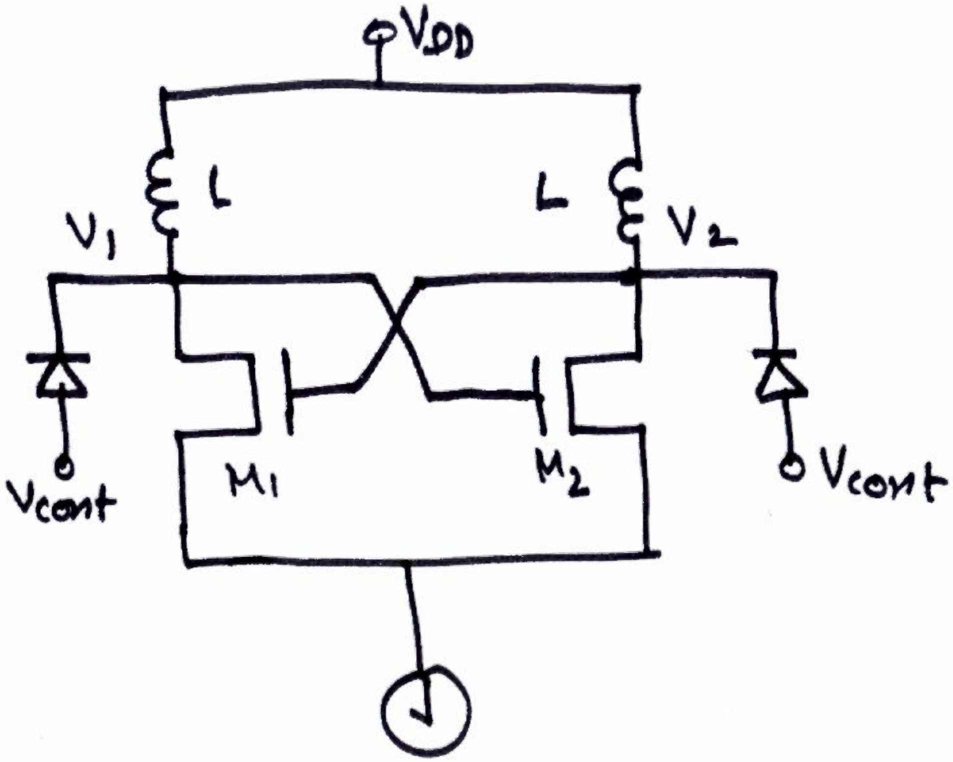
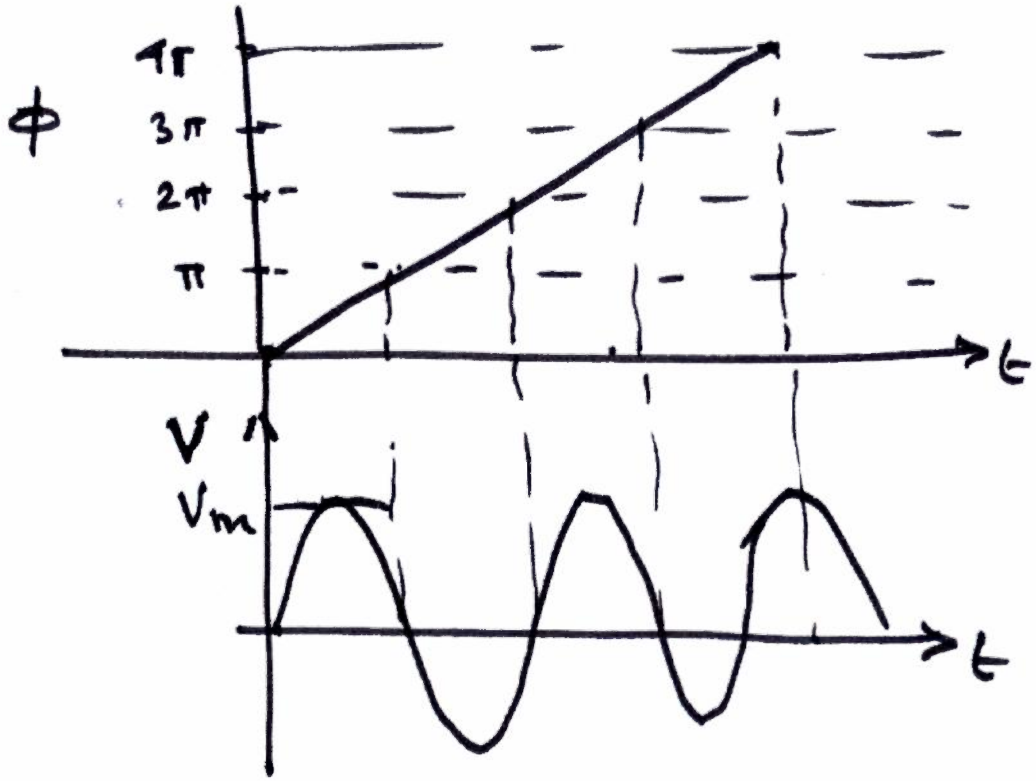
Tuning LC Oscillator



$$C_{Varactor} = \frac{C_0}{\left(1 + \frac{V_R}{\phi_B}\right)^m}$$

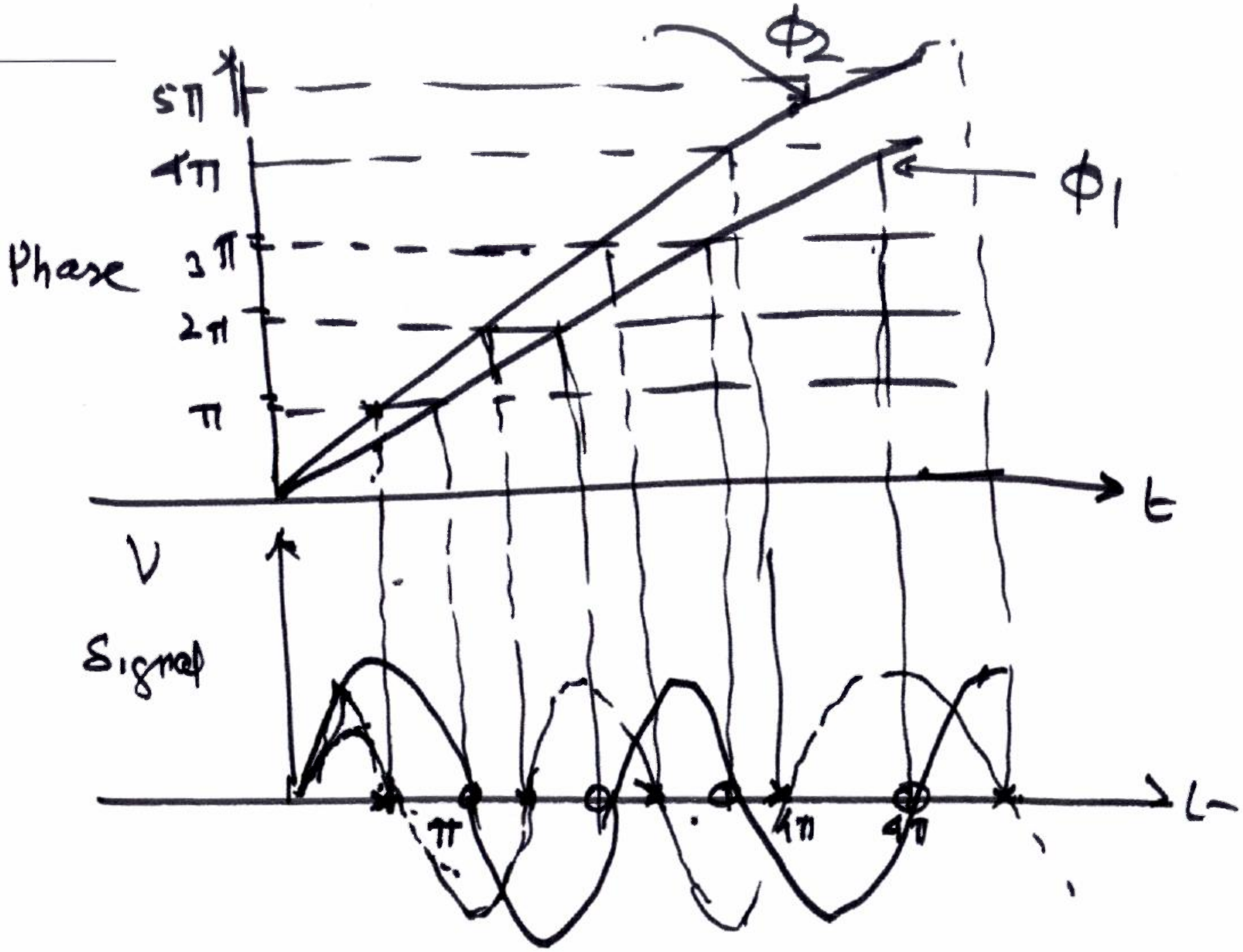
$m = 0.4$ to 0.5

Mathematical Model of VCO



$$\omega = \frac{d\phi}{dt}$$

$$\omega t = \phi$$



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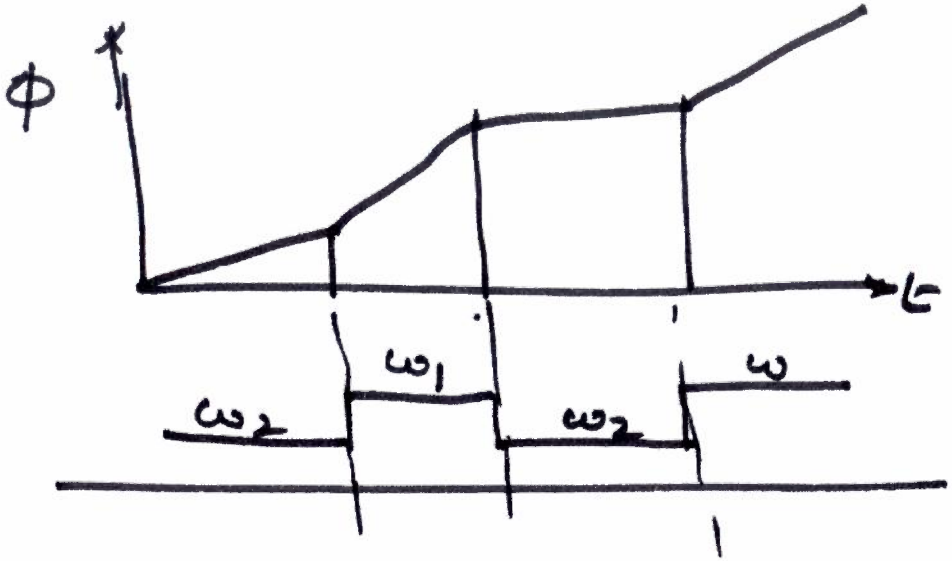
$$\therefore \boxed{\frac{d\phi}{dt} = \omega}$$



$$\phi = \int \omega dt + \phi_0$$

In a VCO

$$\omega_{out} = \omega_0 + K_{vco} V_{cont}$$

We have oscillator output

$$V_o(t) = V_M \cos \phi t = V_M \cos \int \omega_{out} dt + \phi_0$$

or $V_{out}(t) = V_M \cos\left\{ \omega_0 t + K_{Vco} \int V_{cont}\, dt + \phi_0 \right\}$

Assume $\phi_0 = 0$

& $V_{cont} = V_m \cos \omega_m t$ (If V_{cont} Varies)

Then $V_{out}(t) = V_M \cos\left\{ \omega_0 t + K_{Vco} \int V_M \cos\omega_m t \, dt \right\}$

$$\cong V_M \cos\omega_0 t - V_0 (\sin\omega_0 t)\left(K_{Vco} \frac{V_m}{\omega_m} \sin\omega_m t \right)$$

$$= V_M \cos\omega_0 t - \frac{K_{Vco} V_M V_m}{2\omega_m} \left[\cos(\omega_0 - \omega_m)t - \cos(\omega_0 + \omega_m)t \right]$$