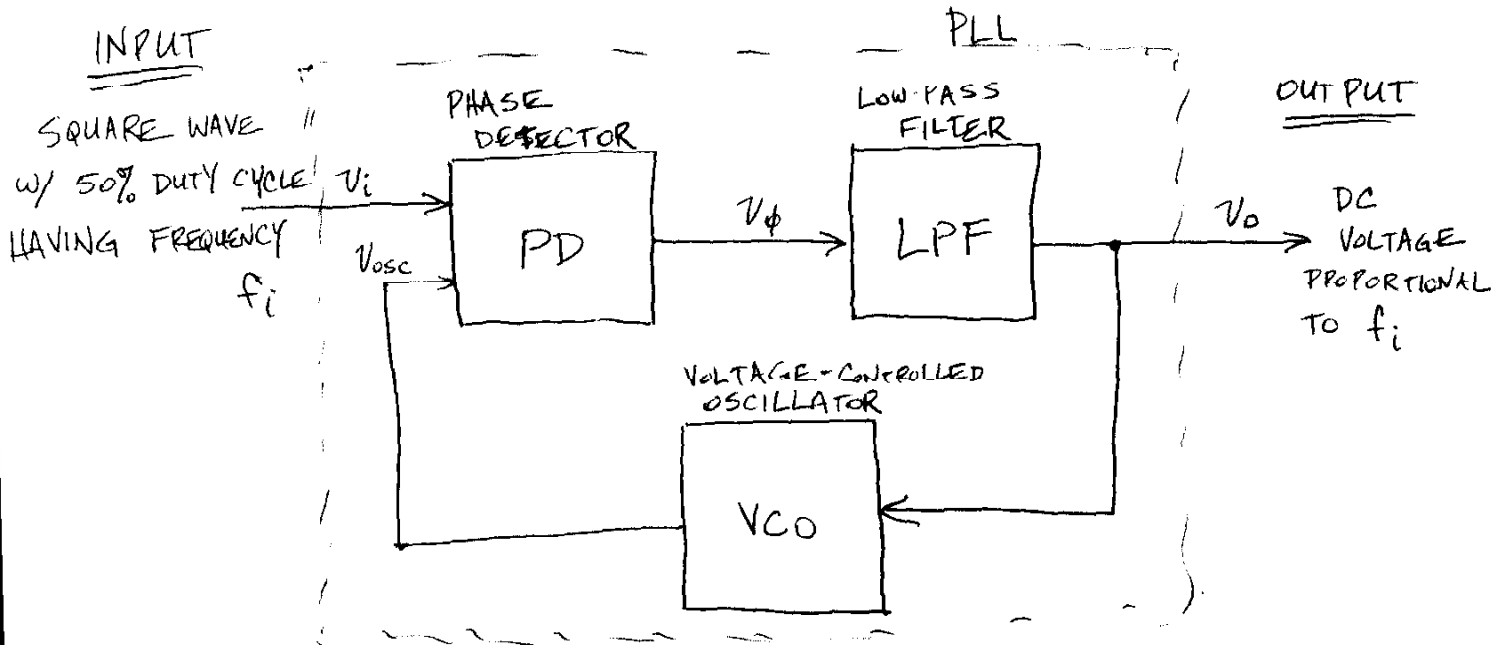


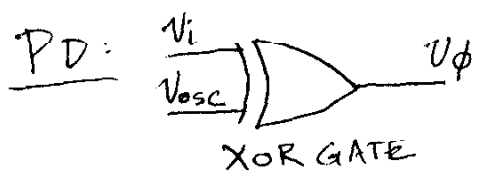
LAB 4

PHASE-LOCKED LOOP (PLL)

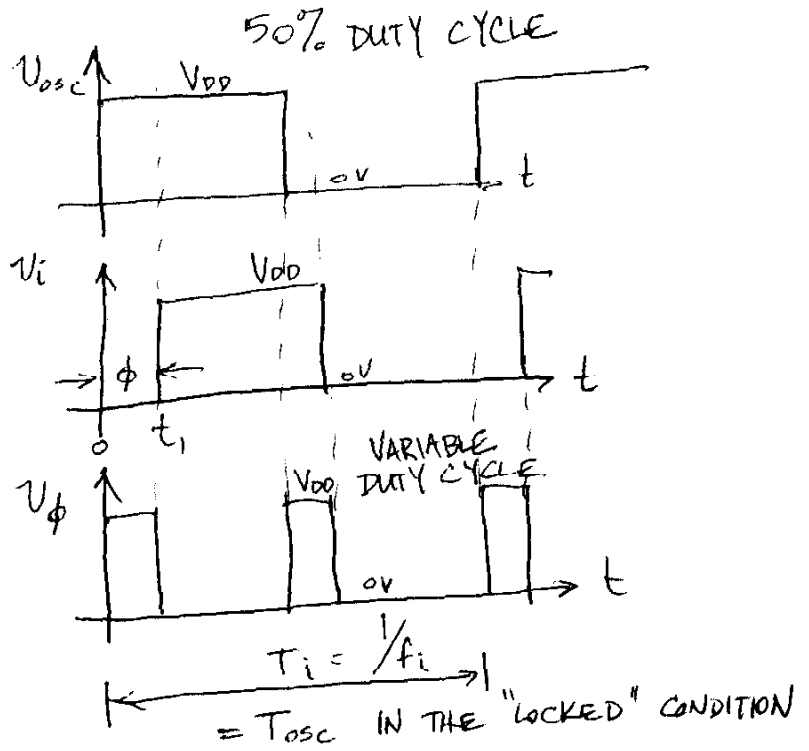
10/2/98



VCO: $f_{osc} = K_o V_o$



WAVEFORMS \Rightarrow



LPF: $f_{cutoff} \ll (f_i)(2)$
FREQUENCY OF $v_\phi(t)$

$V_o(t) = \underbrace{V_o}_{\text{DC VALUE OF } v_\phi(t)} + \underbrace{\hat{V}_o}_{\text{SMALL AC RIPPLE (IDEALLY = 0)}}$

$V_o(t) \approx V_{DD} \left(\frac{t_1}{T_i/2} \right) = V_{DD} \left(\frac{\phi}{\pi} \right)$

PHASE-LOCKED LOOP CONCEPTS :

THE PLL TRIES TO MAKE f_{osc} THE SAME AS f_i

THIS IS THE MAIN ACTION OF THE FEEDBACK.

WHEN $f_{osc} = f_i$, THE PLL IS "LOCKED".

- IF $v_i = 0V$ (GROUNDED, NO INPUT), v_o WILL BE EQUAL TO $\frac{V_{DD}}{2}$ BECAUSE v_{osc} WILL BE THE ONLY INPUT TO THE PD. (SINCE v_{osc} HAS A DUTY CYCLE OF 50%, THE D.C. AVERAGE OF $v_\phi = v_{osc}$ IS $\frac{V_{DD}}{2}$) WHEN $v_o = \frac{V_{DD}}{2}$, $f_{osc} \hat{=} f_o$ WHERE f_o IS CALLED THE "FREE-RUNNING FREQUENCY."
- IF NOW v_i IS ENERGIZED AND HAS THE SAME FREQUENCY AS f_o , (THE FREE-RUNNING FREQUENCY) THE OUTPUT v_o WILL REMAIN AT $\frac{V_{DD}}{2}$. THEREFORE, IN STEADY STATE, ϕ (THE PHASE SHIFT BETWEEN v_i AND v_{osc}) WILL BE EQUAL TO $\pi/2$ AND v_ϕ WILL HAVE A DUTY RATIO OF 50%.