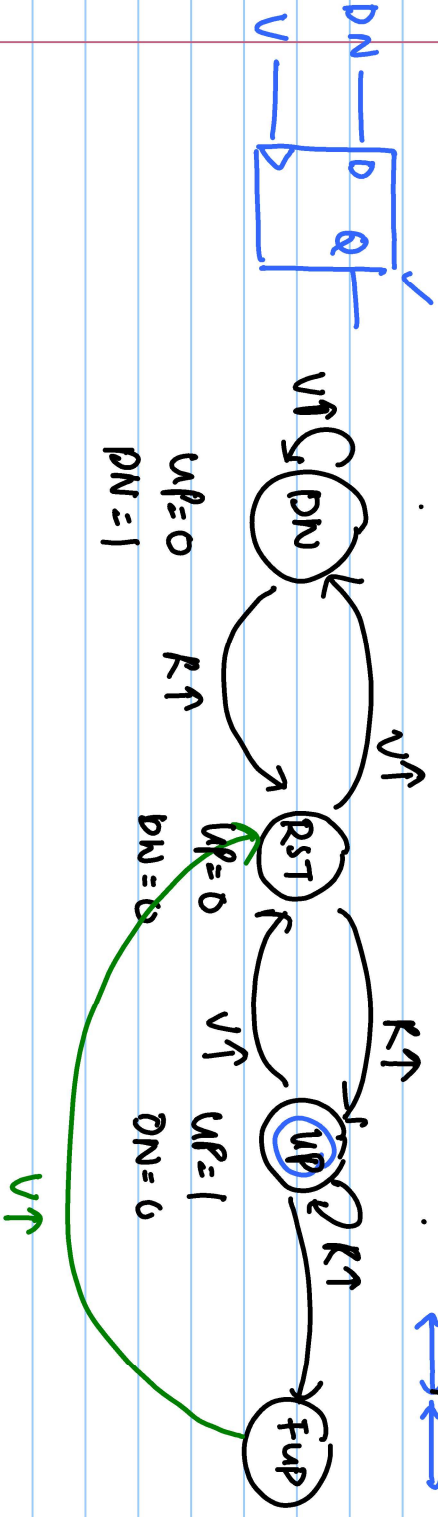
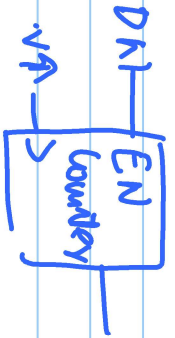
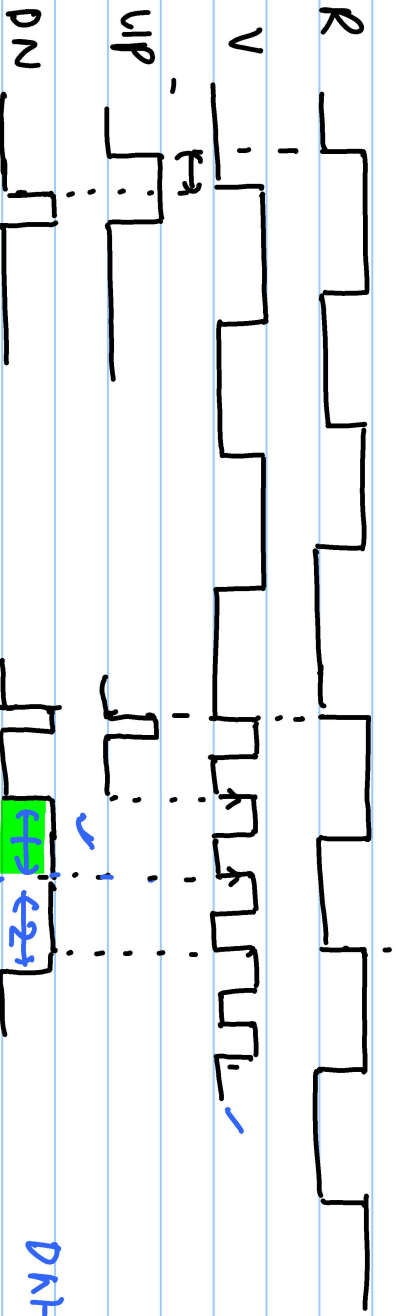
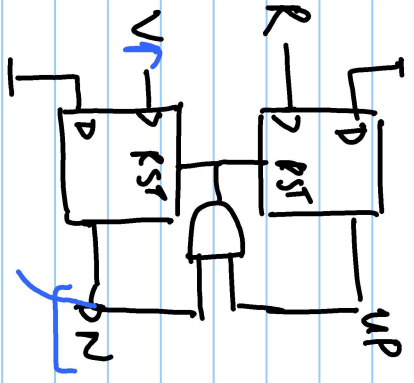
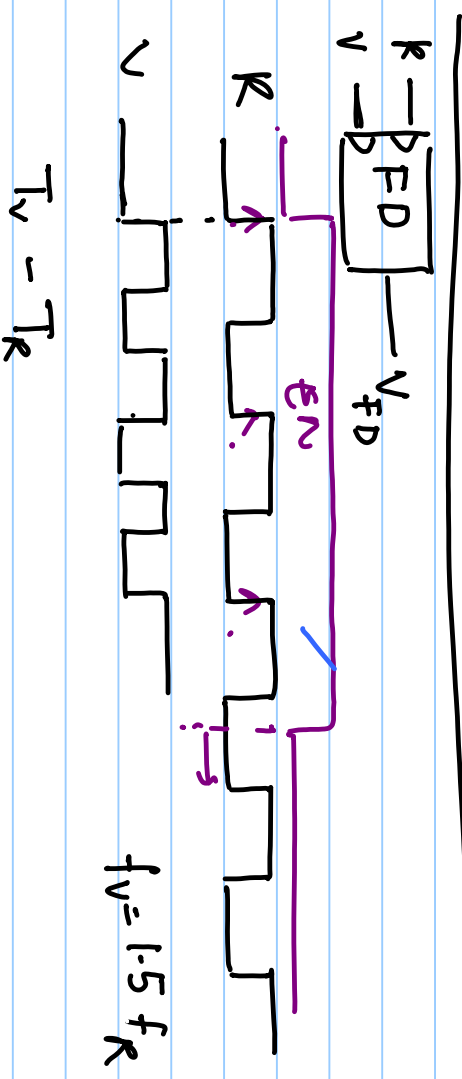
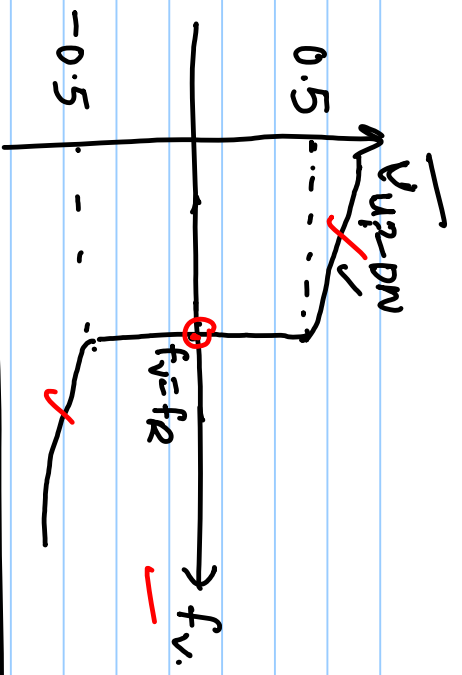
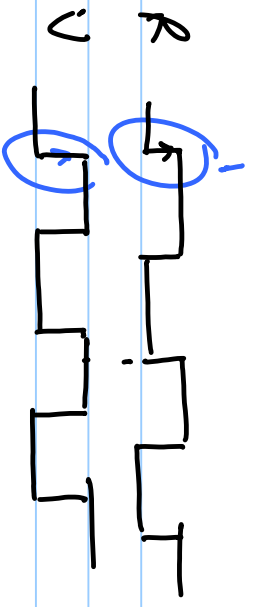


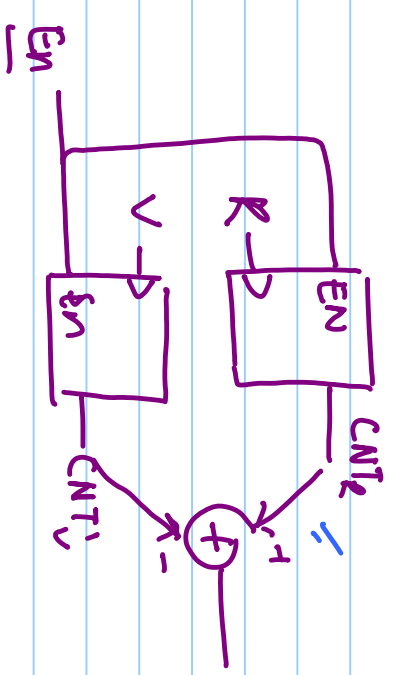
# Lecture #12

## Phase Frequency Detector (PFD) (3-state PFD)





$f_v = 1.5 f_R$



$E_N$  HILK (T<sub>H</sub>)

$CNT_R =$

$\left[ \frac{T_H}{T_R} \right]$

$CNT_V =$

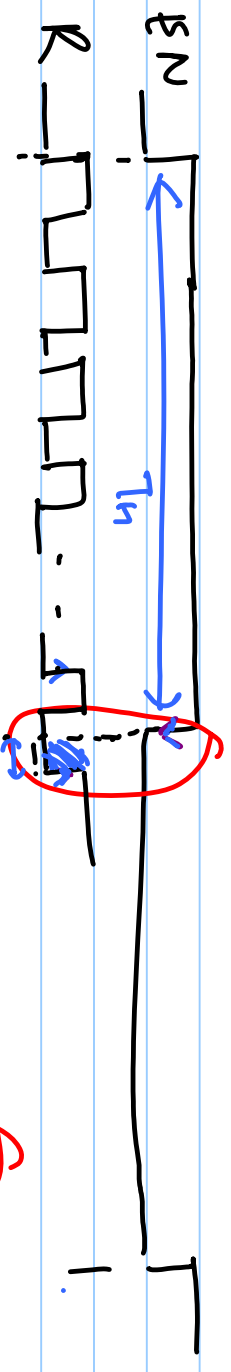
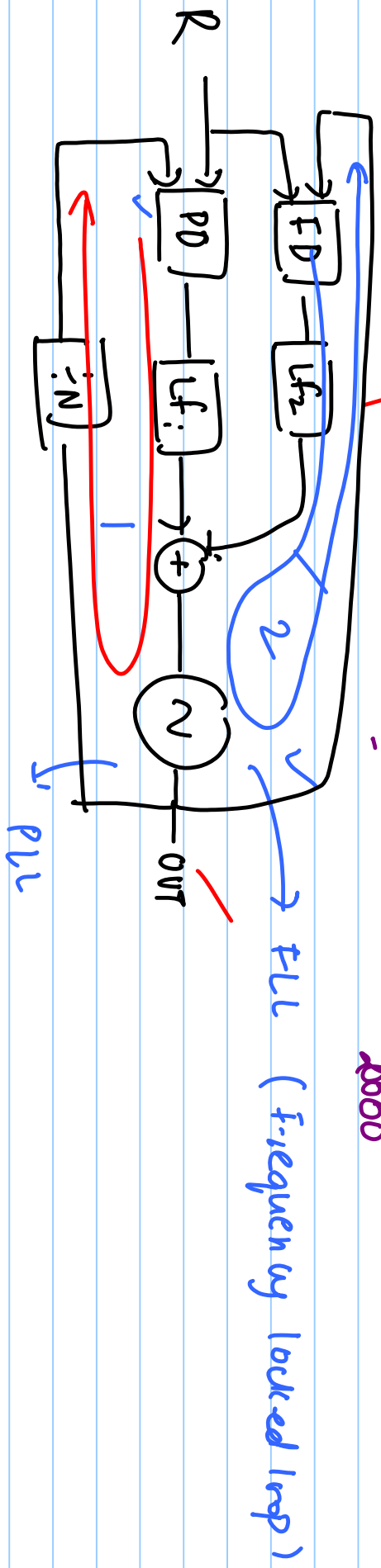
$\left[ \frac{T_H}{T_V} \right]$

$CNT_R - CNT_V =$

Eq:  $T_r = 1 \text{ms}$  |  $CNT_R = 1000$  |  $T_r = \frac{1 \text{ms}}{1000} = 1 \mu\text{s}$

$T_r = 1 \mu\text{s}$

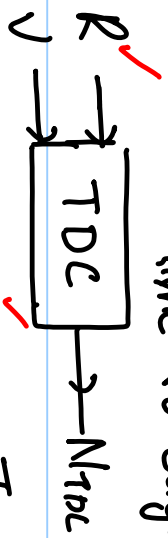
$T_V = 0.8 \mu\text{s}$  |  $CNT_V = 2000$  |  $T_V = \frac{1 \text{ms}}{2000} = 0.5 \mu\text{s}$



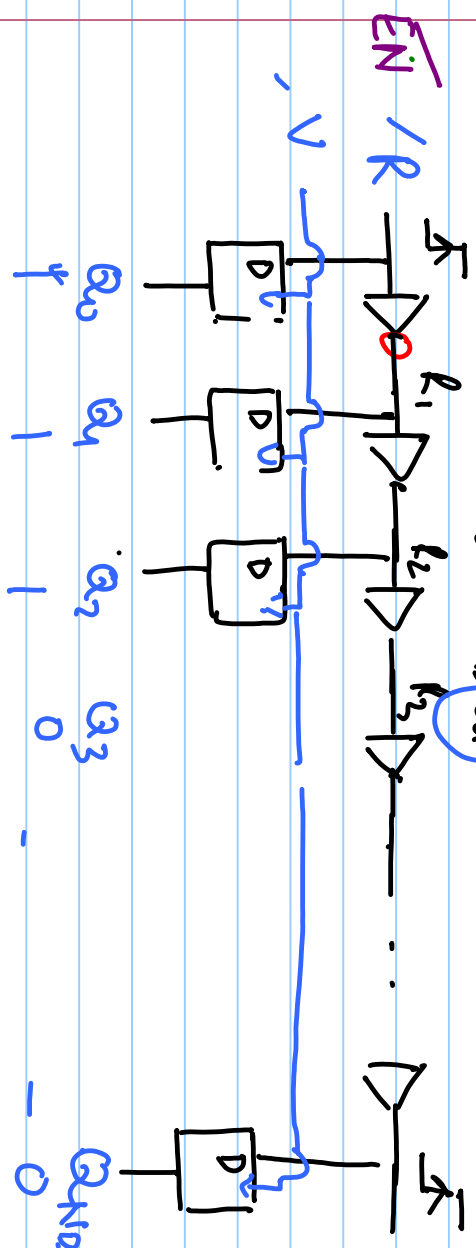
$CNT_R \rightarrow T_r = \frac{T_H}{CNT_R}$

$T_H = T_r \times CNT_R = N_{T_{osc}} \times T_d$

Time to digital converter



$$T_D = N D t_d$$



$t_d$ : delay of inverters  
buffer

