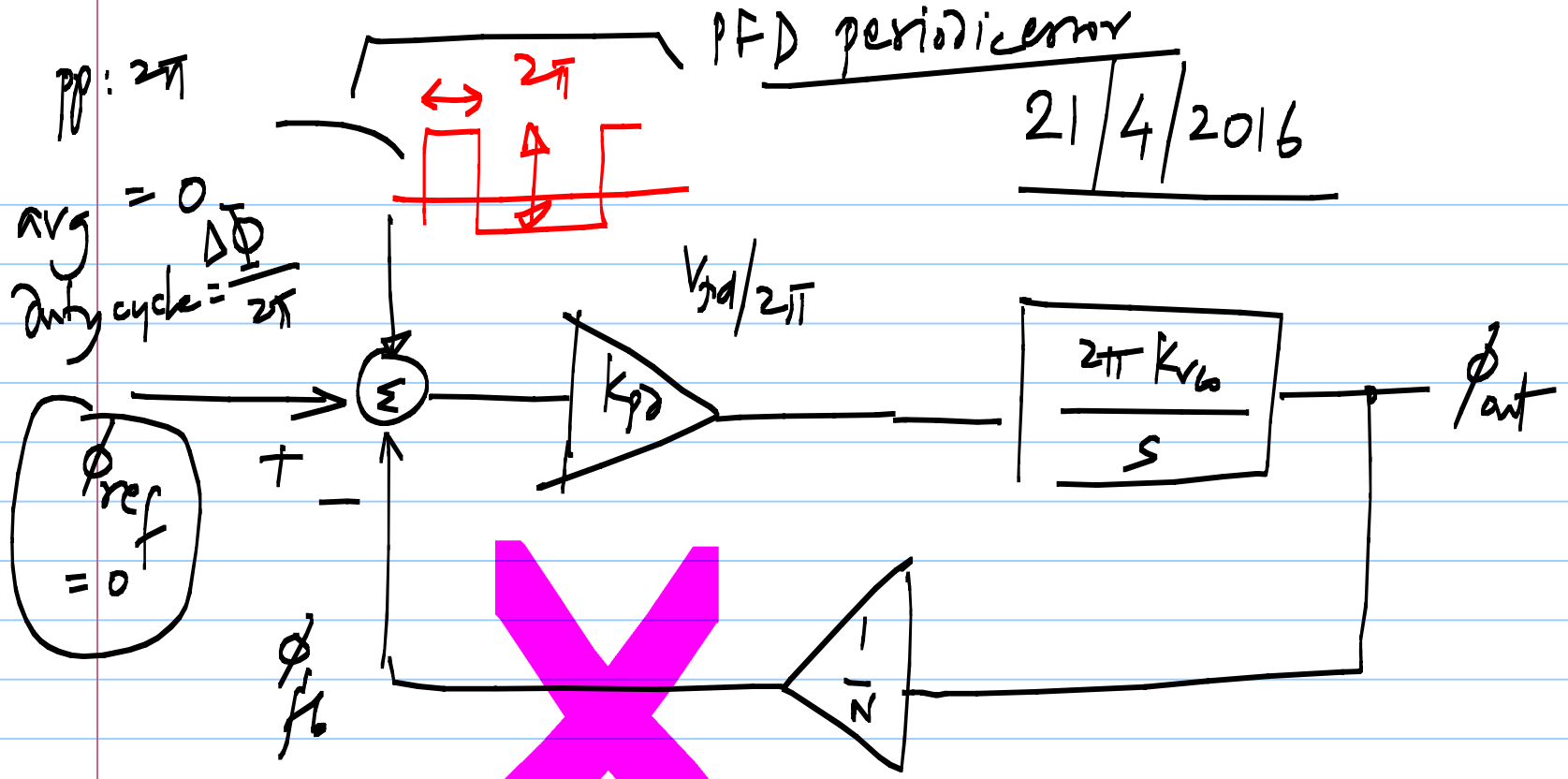
PFD periodic error

21/4/2016

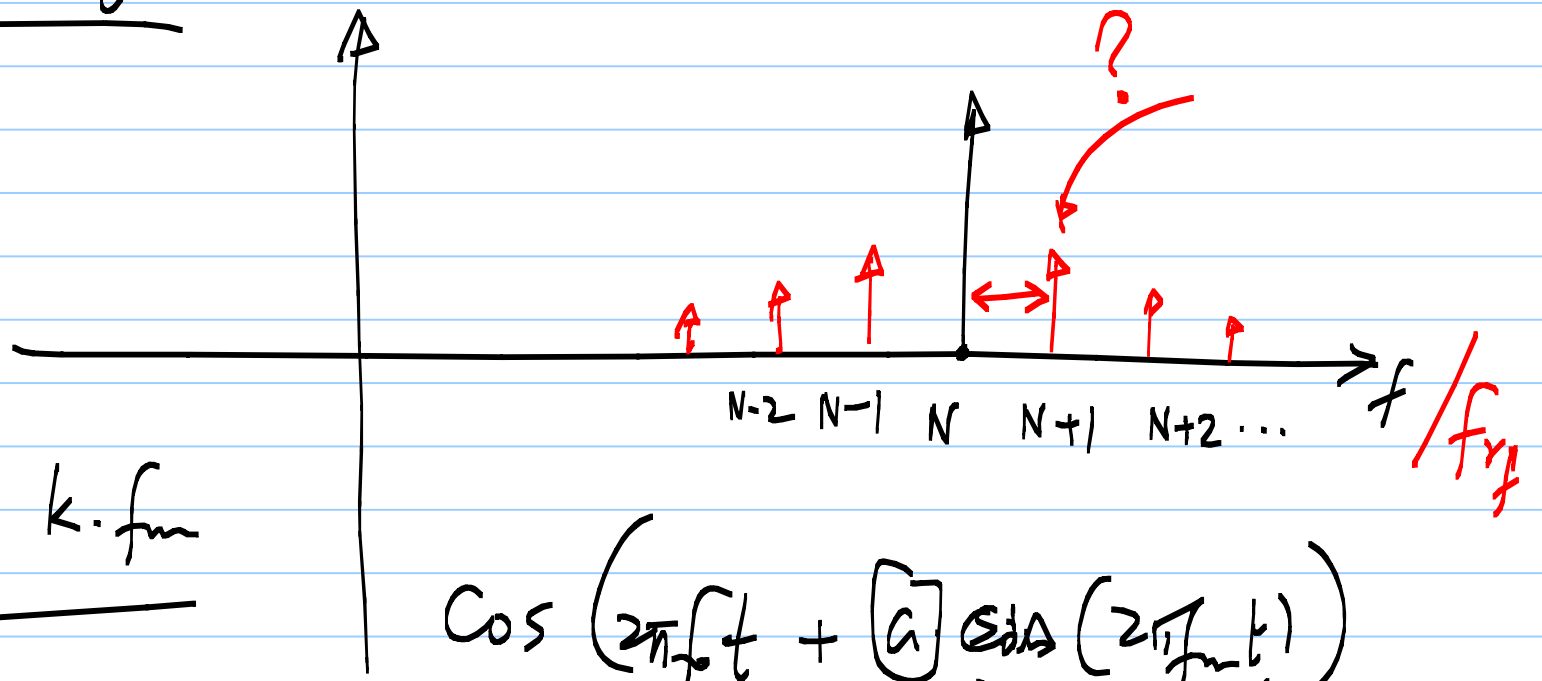


$$\Delta\Phi = \frac{\Phi_{ref} - \Phi_{fb}}{\delta} = \frac{N f_{out} - f_0}{K_{VCO} \cdot K_{PD}}$$

ϕ_{out} : Components @ f_{ref} and its harmonics

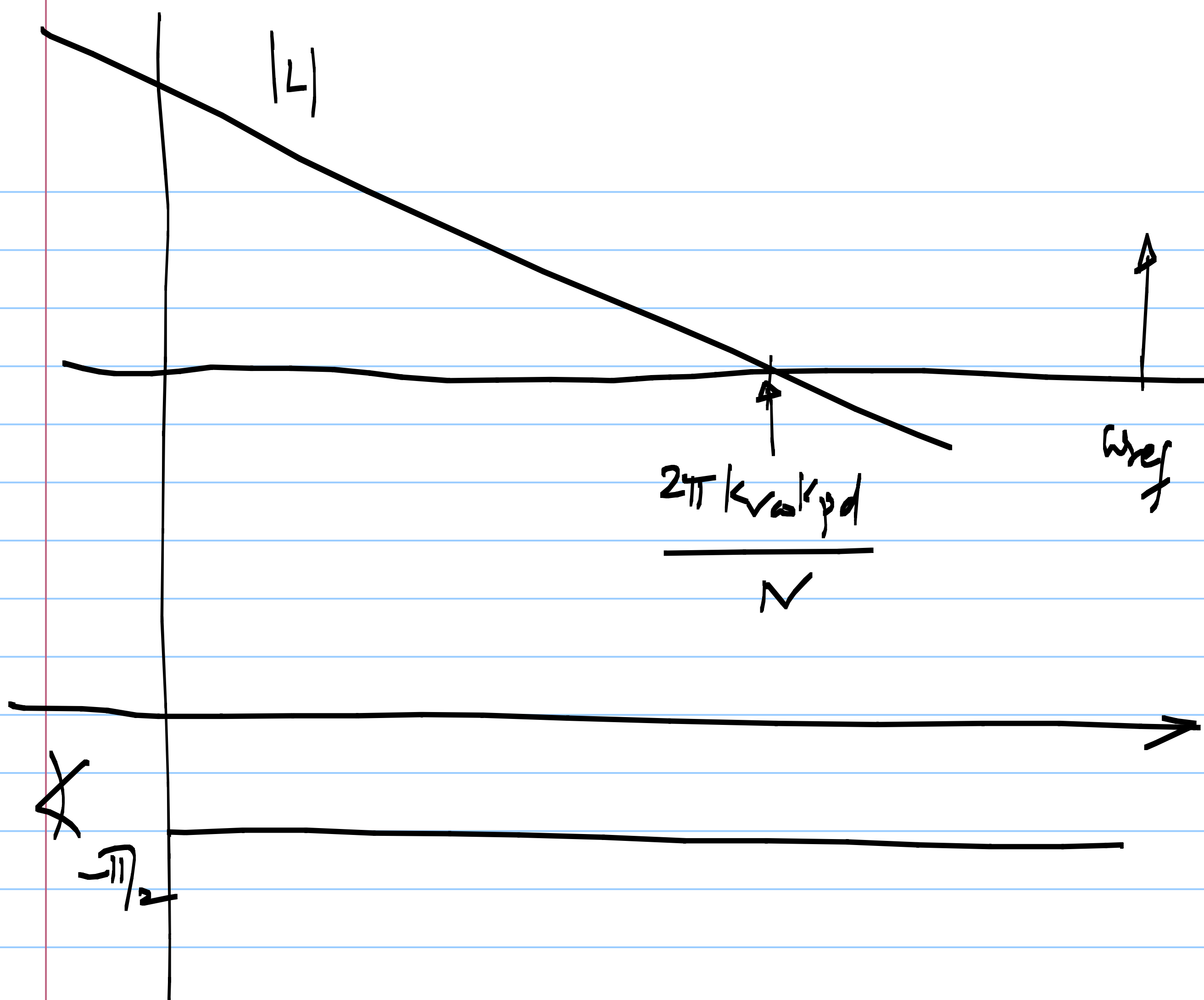
$$\cos\left(2\pi N f_{ref} \cdot t + \phi_{ref} + \phi_{out}\right)$$

output signal:

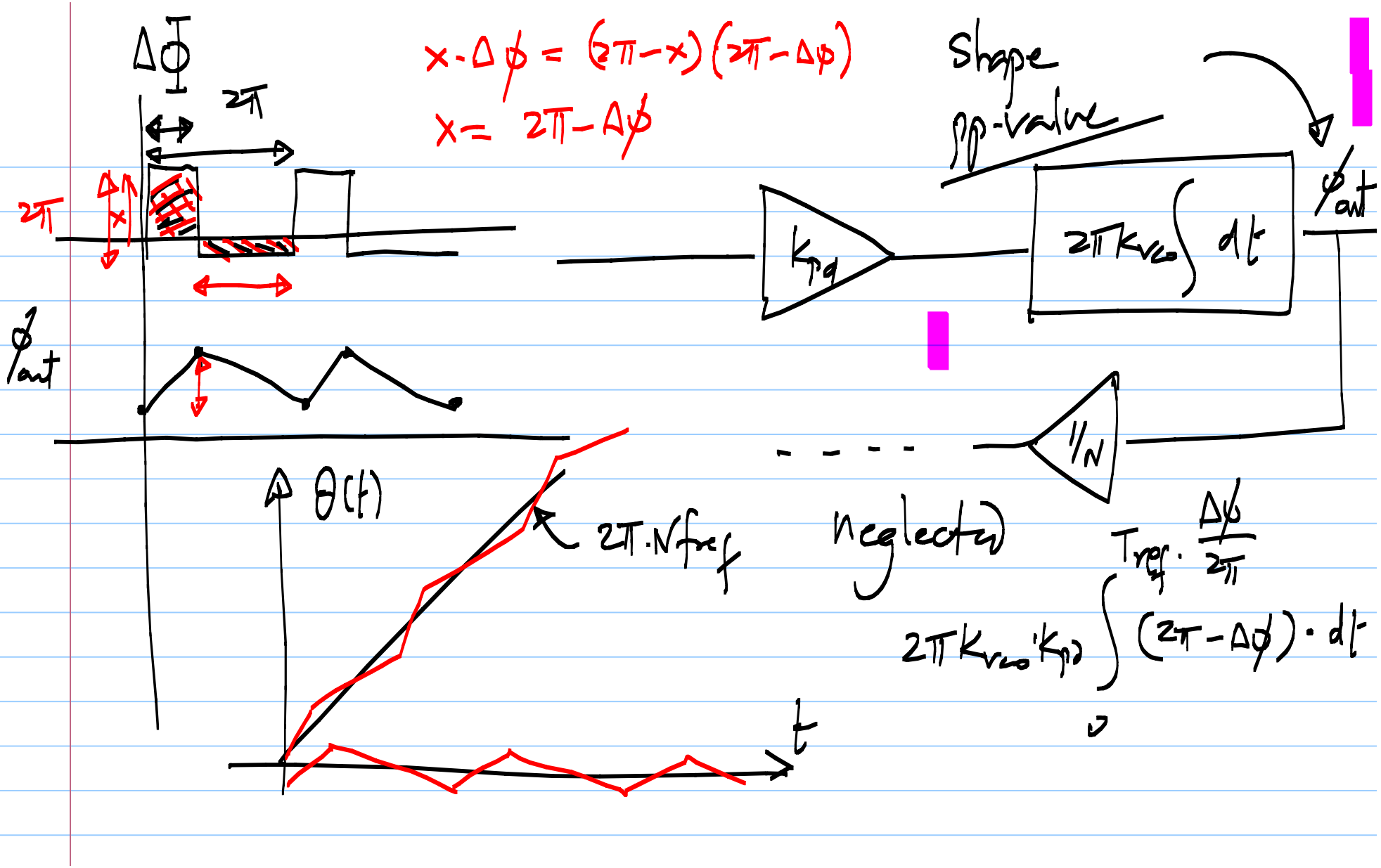


$f \pm k \cdot f_m$

$$\cos\left(2\pi f_0 t + a \sin\left(2\pi f_m t\right)\right)$$



ref. freq $\geq$ 10x BW of the PLL


ΔΦ
2π
x
2π
Φout
θ(f)
2π·Nref
t
x·Δφ = (2π−x)(2π−Δφ)
x = 2π − Δφ
Shape
pp-value
Kpd
2πKvco ∫ dt
Φout
1/N
neglected
Tref · Δφ/2π
2πKvco·Kpd ∫ (2π − Δφ) · dt

$$\phi_{out_{pp}} = 2\pi \cdot K_{VCO} \cdot K_{pd} \cdot (2\pi - \Delta\phi) \frac{\Delta\phi}{2\pi} \cdot T_{ref}$$

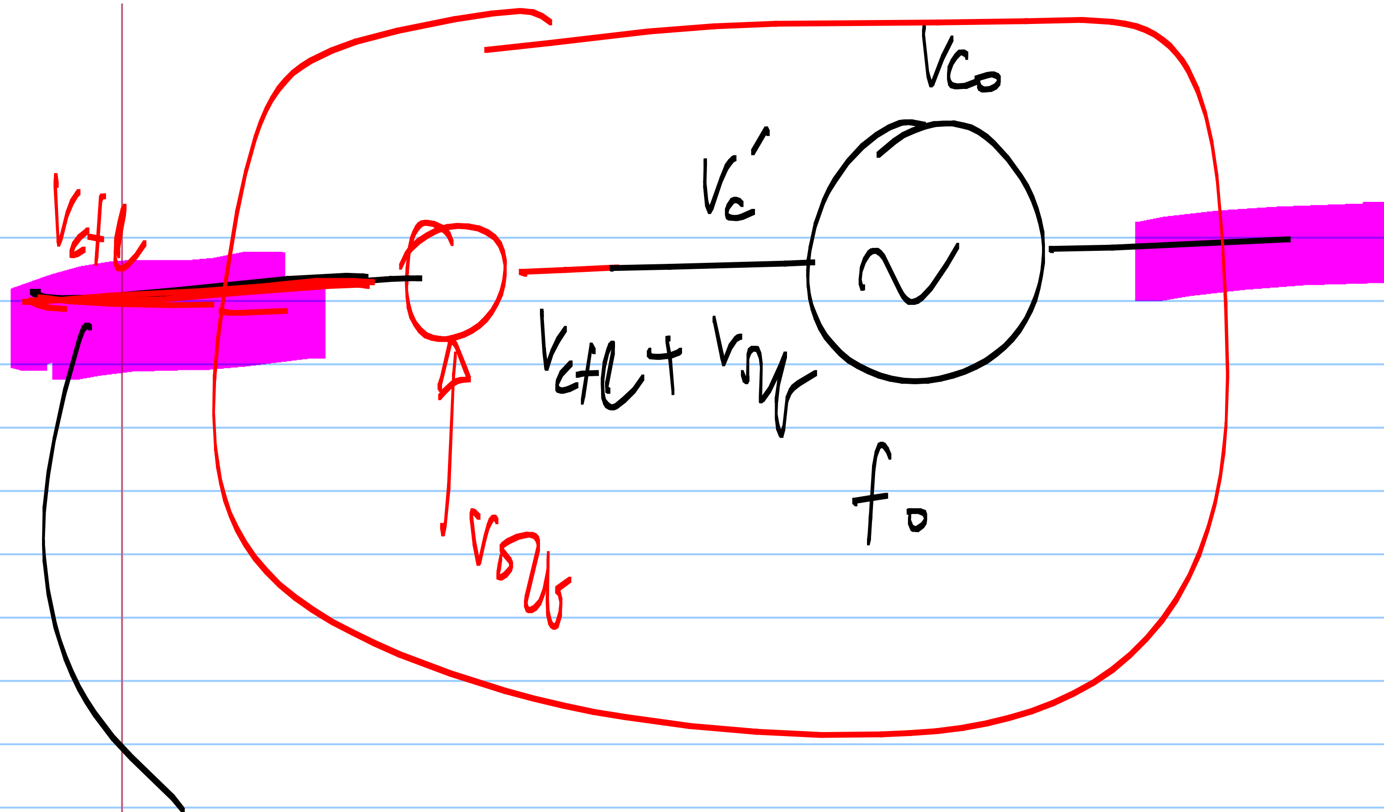
$$= K_{VCO} \cdot K_{pd} (2\pi - \Delta\phi) \cdot \Delta\phi \cdot T_{ref}$$

$f_{ref} = 10MHz$
$N = 100$
$N = 101$
$f_{out} = 1GHz$
$1.01GHz$
$\pi K_{VCO} \cdot K_{pd} \ll 20MHz$
$\pi K_{VCO} K_{pd} = 0.2MHz$

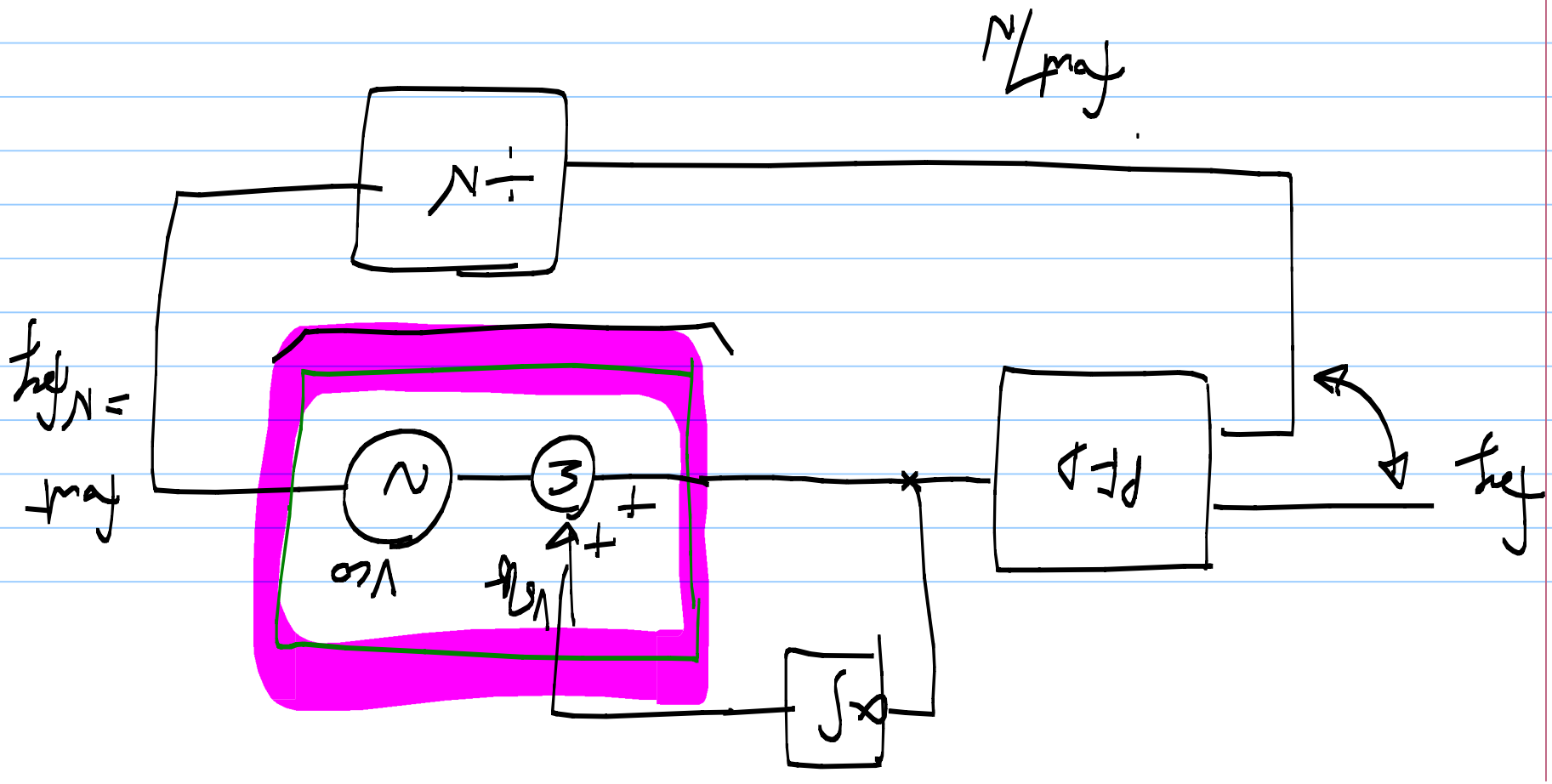
$$\phi_{out,pp-max} = K_{VCO} \cdot K_{pd} \cdot \pi^2 \cdot T_{ref} \ll 2\pi$$

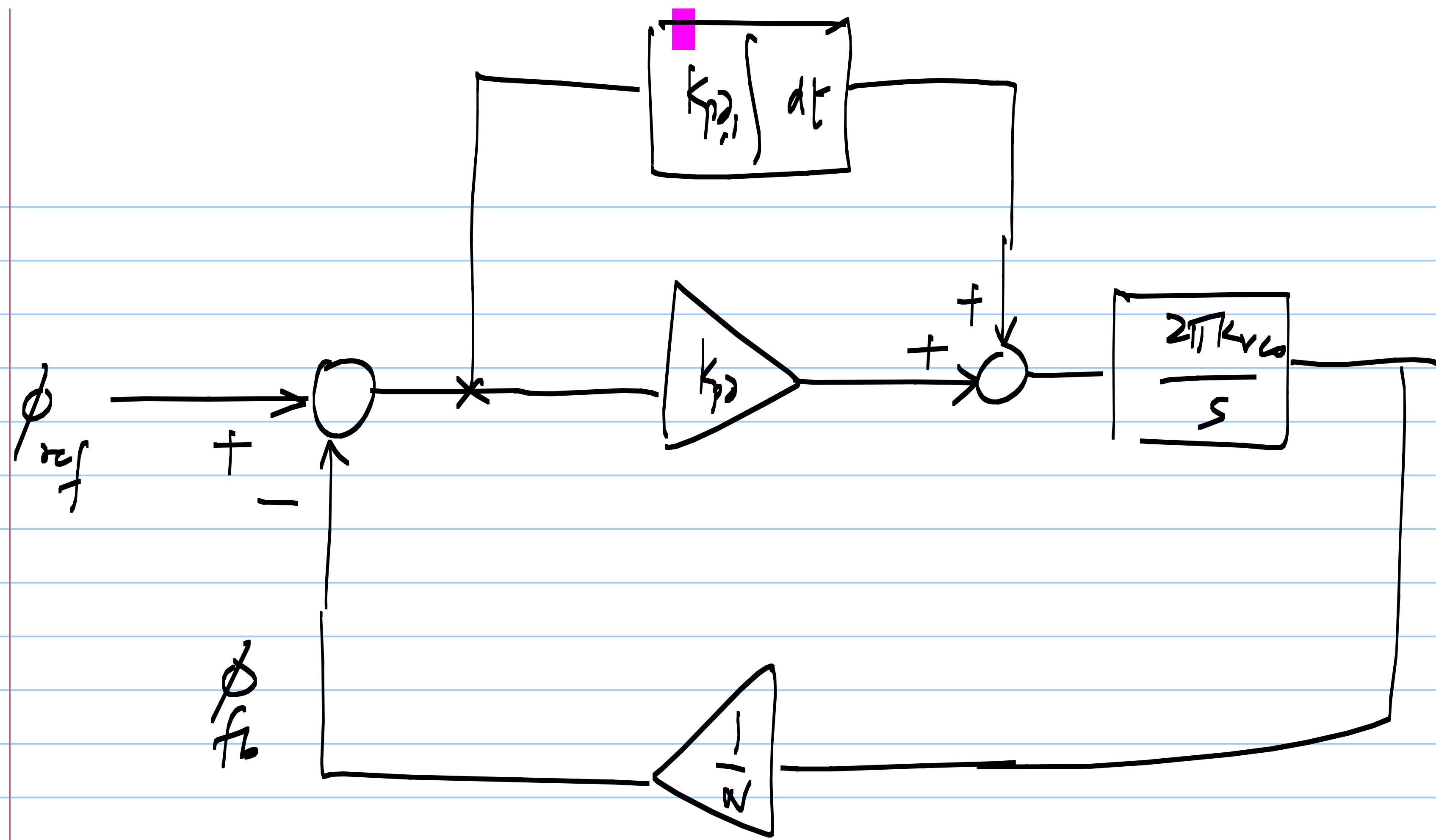
$$\pi \cdot K_{VCO} \cdot K_{pd} \ll \frac{2}{T_{ref}} = 2 f_{ref}$$

$$|N f_{ref} - f_0| = \pi \cdot K_{pd} \cdot V_{LG}$$



$V_{ctl} = 0 \longrightarrow f_0 + K_{VCO} \cdot v_{sig}$




ϕ_{ref}
+
−
$K_{pd,i} \int dt$
K_{pd}
+
+
$\frac{2\pi K_{vco}}{s}$
ϕ_{fb}
$\frac{1}{N}$