SMDP Instructional Enhancement Programme: 13-24 Nov. 2006

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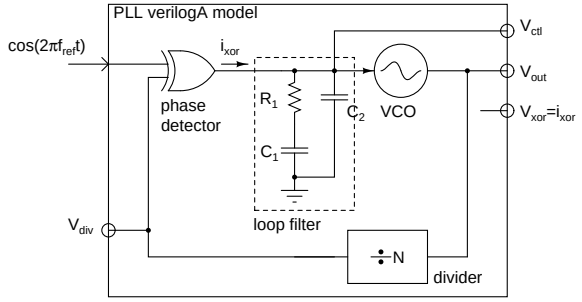

Figure 1:

- Repeat the simulations in the previous assignment, replacing the XOR phase detector with a tri state phase detector.

  [The PLL should multiply up a 10 MHz input to a 200 MHz output. Adjust the loop filter to get a unity loop gain at 0.2 MHz, a zero at 0.02 MHz, and a pole at 0.5 MHz. ($I_{cp} = 1\ \mu$A and $K_{vco} = 30$ MHz/V)]

  Run a transient simulation with `errpreset = conservative` and observe the results

  Tighten the tolerances (reltol) by an order of magnitude and observe the results

  Force simulations every 25 ps using `strobeperiod` and observe the results

  Observe the settling of the control voltage, output waveform of the VCO, divider output, phase detector output. What is the settling time? Does the settling correspond to hand calculated value of the loop bandwidth?

  Run the simulations for 50 μs and compute the power spectral density of the output using `psd` with `Hann` window. What is the level of the reference feedthrough? You need to choose an appropriate length of the output at the end of the simulation and perform dft on it. Compare the reference feedthrough of the PLL using a tri state phase detector with one using an XOR phase detector.

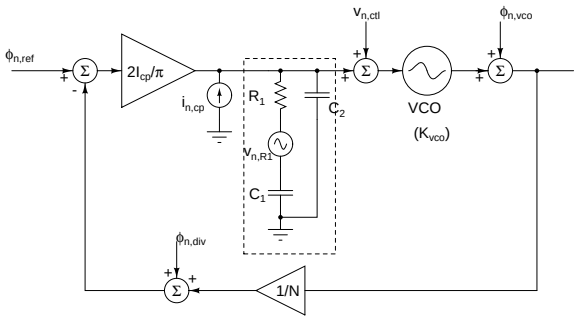

Figure 2:

- Construct the linear model of the PLL using an XOR phase detector as shown in Fig. 2. Compute the transfer functions from $\phi_{n,ref}$, $\phi_{n,vco}$, $\phi_{n,div}$, $i_{n,cp}$, $v_{n,ctl}$, $v_{n,R}$. They respectively model the phase noise of the reference, the vco, and the divider, noise from the charge pump, noise injected into the control voltage node of the vco, and noise from the loop filter. What are the dimensions of each of these transfer functions?