EE539: Analog Integrated Circuit Design; Lecture 6

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Other Components on IC

- Higher Voltage tolerance transistors - Made using thicker oxide and longer L.
- High resistivity poly(not silicided) - typically $300\Omega/\square$
- High density metal-metal capacitances (capacitance is linear)
- Inductance - generally used at high freqs (RFICs). Generally, thick metal is used to reduce resistive component. The value of inductance is usually in nH range, but it is fairly accurate.

Mismatch

- Generally, there are lot of component variations in ICs due to variations in the values of μ, C_{ox}, R_{sh}, Capacitance density. W and L are more accurate.
- Though absolute values vary by around 20%, relative values vary only by around 1%.
- Other variations are variations with process (wafer to wafer) and variations with temperature.

Capacitors

Let us consider a capacitor of dimensions W,L. Let us assume that one set of parallerl sides are perfect and the other set has imperfections. Further, assume that the capacitor is formed of 'N' strips of length $L_\triangle$.

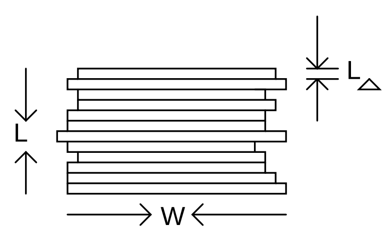

Figure 1: Capacitor Mismatch

$C - C_{ideal} = \frac{\epsilon L_{\Delta}}{t} \sum_{k=1}^{N} \Delta W_k$
ΔW_k : Gaussian with mean = 0 and variance = $\sigma^2_{\Delta W}$
$\sigma^2(C - C_{ideal}) = \frac{\epsilon L_{\Delta}}{t}^2 N \sigma^2_{\Delta W}$
$C^2_{ideal} = \frac{\epsilon L_{\Delta}}{t}^2 N^2 W^2_m$
$\frac{\sigma^2_{\Delta} C}{C^2_{mean}} = \frac{1}{N} \frac{\sigma^2_{\Delta W}}{W^2_m}$
$\frac{\sigma_{\Delta} C}{C_{mean}} \alpha \frac{1}{N} \alpha \frac{1}{\sqrt{C_{mean}}}$

So, we see that as the size increases, the relative mismatch decreases.