

EE6320 RF Integrated Circuits Homework 3

1. A direct conversion receiver is shown in figure 1 below. The LNA has a gain of A_1 and Noise Factor F_1 ; each of the I and Q mixers has high input impedance and input-referred noise voltage $\overline{v_n}$. Assume that the noise of the LPF is negligible. If the I and Q outputs are simply added, determine the over noise figure in terms of block noise figures.
2. A cross coupled oscillator can be re-drawn as two tuned amplifiers placed in a feedback loop as shown in figure 2 below. If the two inductors exhibit a mismatch of ΔL , determine the oscillation frequency by calculating the frequency at which the total phase shift around the loop reaches 360° .
3. A common-source amplifier stage is loaded by a parallel RLC tank. Prove that the Quality Factor $[Q = (\omega_0/2) \cdot (d\phi/d\omega)]$ is equal to $R_p/(L\omega_0)$.

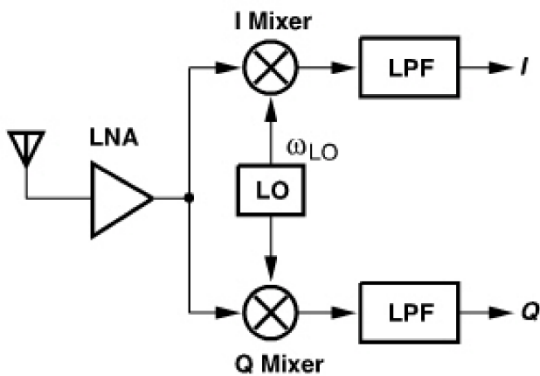


Figure 1

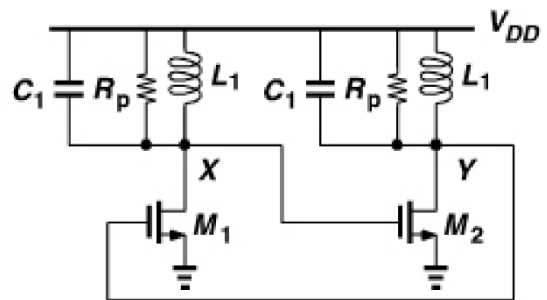


Figure 2