ABSTRACT

Low Noise Amplifier and Dow-Conversion Mixer Design

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This dissertation presents a new approach to improve the performance of the low noise amplifier (LNA) and the down-conversion mixer. The method we proposed is based on the capacitive cross-coupling technique in the differential common-gate input stage. A detail theoretical analysis has revealed that by using capacitive cross-coupling technique the noise in the input transistors is minimized, the third-order intermodulation performance is slightly improved and the second-order intermodulation performance is significantly improved. Moreover, the capacitive cross-coupling doubles the effective transconductance of input transistors, which results in reducing current consumption. Compared to the conventional differential common-gate input structure, the proposed capacitive cross-coupling technique is demonstrated in two design examples, namely the LNA and the down-conversion mixer. A novel LNA and down-conversion mixer with capacitive cross-coupling are proposed in this dissertation. Both LNA and mixer were designed for 900MHz direct-conversion receiver applications. The prototypes have been implemented and fabricated using AMI 0.5μ CMOS technology. The measurement results of the fabricated chips illustrated the feasibility of the proposed technique. As an extension to this research work, cross-coupling with general impedance is also presented and discussed.