

A Low Phase Noise CMOS LC Oscillator with Tail Current-Shaping

Authors : Amir Mahdavi

Abstract : In this paper, a circuit topology of voltage-controlled oscillators (VCO) which is suitable for ultra-low-phase noise operations is introduced. To do so, a new low phase noise cross-coupled oscillator by using the general topology of cross-coupled oscillator and adding a differential stage for tail current shaping is designed. In addition, a tail current shaping technique to improve phase noise in differential LC VCOs is presented. The tail current becomes large when the oscillator output voltage arrives at the maximum or minimum value and when the sensitivity of the output phase to the noise is the smallest. Also, the tail current becomes small when the phase noise sensitivity is large. The proposed circuit does not use extra power and extra noisy active devices. Furthermore, this topology occupies small area. Simulation results show the improvement in phase noise by 2.5dB under the same conditions and at the carrier frequency of 1 GHz for GSM applications. The power consumption of the proposed circuit is 2.44 mW and the figure of merit (FOM) with -192.2 dBc/Hz is achieved for the new oscillator.

Keywords : LC oscillator, low phase noise, current shaping, diff mode

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