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Noise and Thermal Analyses of Memristor-Based Phase Locked Loop Integrated Circuit

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Abstract : The memristor is considered as one of the promising candidates for mamoelectronic engineering and applications. Owing to its high compatibility with CMOS, nanoscale size, and low power consumption, memristor has been employed in the design of commonly used circuits such as phase-locked loop (PLL). In this paper, we designed a memristor-based loop filter (LF) together with other components of PLL. Following this, we evaluated the noise-rejection feature of loop filter by comparing the noise levels of input and output signals of the filter. Our SPICE simulation results showed that memristor behaves like a linear resistor at high frequencies. The result also showed that loop filter blocks the high-frequency components from phase frequency detector so as to provide a stable control voltage to the voltage controlled oscillator (VCO). In addition, we examined the effects of temperature on the performance of the designed phase locked loop circuit. A critical temperature, where there is frequency drift of VCO as a result of variations in control voltage, is identified. In conclusion, the memristor is a suitable choice for nanoelectronic systems owing to a small area, low power consumption, dense nature, high switching speed, and endurance. The proposed memristor-based loop filter, together with other components of the phase locked loop, can be designed using memristive emulator and EDA tools in current CMOS technology and simulated.

Keywords : Fast Fourier Transform, hysteresis curve, loop filter, memristor, noise, phase locked loop, voltage controlled oscillator
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