ABSTRACT

Automatic Tuning for Continuous-Time High Frequency Continuous-Time Bandpass Filters. (December 2002)
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A novel automatic tuning scheme for continuous-time bandpass filters is presented. It is based on gain comparison at three different frequencies. The tuning scheme incorporates a PLL-based frequency synthesizer which generates the required references, a peak detector, two switched-capacitor integrators which conduct gain comparison and generate frequency and quality factor tuning voltages, and a state machine to generate synchronous clocks for all the building blocks in the tuning circuitry. Q-factor is digitally set through the frequency divider of the frequency synthesizer. The tuning scheme does not rely on the assumption that Q is equal to filter's passband gain.

The tuning scheme is robust and can be also applied to filters in which the Q-factor is not a known function of their passband gain. The tuning scheme has significant advantage over previously published tuning schemes for high-frequency, high-Q filters. It has small silicon area overhead, small power consumption, and very good frequency and Q-tuning accuracy.

Theoretical analysis and experimental results are provided. A second-order transconductance-C biquadratic filter is designed to demonstrate the proposed tuning circuitry. The test chip is fabricated in AMI 0.5μm CMOS process. The measured results show the frequency error is 0.25%, Q error is 3% for a 200 MHz filter with desired Q of 28.6. Other results such as filter's dynamic range, noise performance and intermodulation are also presented. In addition, a design of 2 GHz active LC filter tuning circuitry and its simulation results are provided.