Thesis Title	On the design of CMOS RMS-to-DC converter and linear electronically tunable OTA
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ABSTRACT

This thesis presents the designs of two new analog integrated circuit building blocks based on CMOS technology. The themes of this work are designed by using current mirrors to be the main structure of the circuits and by using the square law characteristic where all MOS transistors are operated in saturation regions. Firstly, a simple integrable circuit technique for the realization of a wide bandwidth current-mode CMOS true RMS-to-DC converter is presented. The realization scheme is based on the implicit computation method. The circuit structure is composed of a squaring circuit, current mirrors and a first-order low-pass filter. The conversion circuit consumes very low power, due to the bias current of the circuit is provided by the root-mean-square current I_{RMS} from the feedback function. The high frequency response of the proposed true RMS-to-DC converter is 100MHz for I_{in}=1.5mA. Secondly, an electronically and linearly tunable CMOS OTA call as EOTA is presented. Where its transconductance gain can be electronically and linearly tuned by the DC bias current. The circuit is constructed from a balanced CMOS OTAs and achieves its linearity by squaring the nonlinear transconductance of the balanced CMOS OTA. This proposed EOTA can be linearly tuned by the bias current for 3 decades. The achieved characteristics of the transconductance gain (g_m) is dependent upon the bias current I_B over the range of 1μA to 1mA (three decades) with the conversion error from simulation result of about 0.68%. The EOTA can linearly convert the input voltage into the output signal current with nonlinearity of less than 1% for the input voltage (V_{in}) in the ranges of -1V to 1V. The frequency response of the EOTA was also studied, where the -3dB bandwidth of about 120 MHz is achieved. The usefulness of the proposed EOTA is demonstrated through application examples, such as a current multiplier, a linearly voltage-controlled current amplifier and a linearly current-controlled CMOS current amplifier. The performances of the proposed circuits are studied through PSPICE simulation results and experimental results.