V. Simulation Results

The whole circuit has been simulated using the ASIZ simulator [14]. Since the dilations of a given SI filter may be controlled by changing the clock frequency, so adjusting the various clock frequencies of the circuits with the same system architecture, one can obtain different scale wavelet functions. Defining I_s=1A, R=1Ω and clock frequency is 100kHz, 50kHz, 25kHz and 12.5kHz, respectively. Fig. 3 shows the impulse response of the wavelet filters with four scales. The simulated impulse response waveforms of the different scale filters achieve the negative peak value 0.1769A at 0.04ms, 0.08ms, 0.16ms and 0.32ms, respectively, which are different from the normalized values of the original waveform. The approximation quality of the first derivative of a Gaussian wavelet is excellent to the ideal wavelet function, which confirms the performance of the SI wavelet filters. Only changing *W/L* of the output current mirror, the output gain of the waveform will be adjusted for the practice applications.

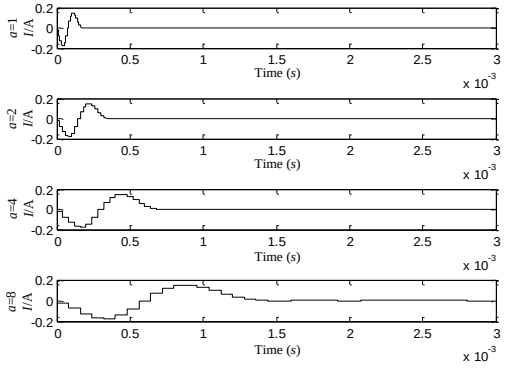

Fig. 3 Simulated impulse responses of the Gaussian filter with four scales.

In order to analyse the effect of finite G_m/G_{ds} ratios in the transistors and parasitic C_{gd} capacitances, another simulation is made. Assuming G_m/G_{ds} and C_{gs}/C_{gd} ratios of 2000, with the biasing current sources assumed as ideal, the frequency response of the wavelet filter is shown in Fig. 4. The simulated frequency response is closed to the ideal frequency response, which indicates that the designed system has litter effect in the sensitivity to the imperfections.

VI. Conclusions

A low voltage and low power analog circuit for implementing the WT using AGA and SI filters is presented. The wavelet base is approximated by AGA method in the time domain. This approximation approach performs well in the practice that it leads to relatively low order approximation. Then the approximating wavelet function is implemented in analog SI filter, based on SI differentiator as main building block. By changing the clock frequency, the SI filter obtains the various scales wavelet function to implement WT. Simulation results the proposed method is effective. Furthermore, from the results obtained, we may deduce this procedure could very well be used to implement other wavelet bases.

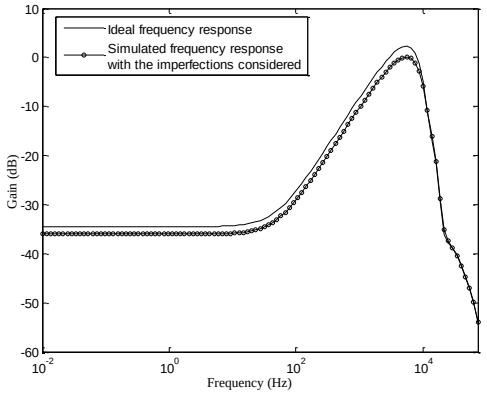

Fig. 4 Simulated frequency response of the Gaussian filter with the imperfections considered (a=1).

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