Practical Realization of UWB Analog FIR-Filter in MIC Technology

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Most modern signal processing systems use a combination of analog and digital techniques in order to accomplish the desired function and take advantage of the best of both. Choosing the right technique might not always be clear and will depend on the expected functionality of the application and the cost, namely for low cost, low power portable devices for the UWB frequency band. According to the Nyquist theorem, the ADC sampling rate for digitizing UWB signals must be on the order of several gigasamples/sec which still is a serious challenge for such devices. Digital FIR filters are widely used in digital signal processing for the realization of filter responses with prescribed frequency behavior. The aim of this paper is to propose a novel design of an analog UWB FIR filter in MIC technology. Only few efforts have been published to produce a broadband analog FIR filter circuit for the microwave frequency range and to the authors' knowledge there is no MIC-technology analog FIR filter covering the whole UWB frequency band.

The new design is based on the concept of the "active node" where the input signal passes through a passive biphase divider to cascading splitter nodes including the time delays of the filter τ. The second output of the splitter node passes through the digital control attenuator unit, a variable gain amplifier, which realizes the filter coefficients (real and biphase from -1 to 1). The Combiner Node sums up the outputs from both control units and the preceding stage, and generates a single output to the following stage. Only one control path is ON at a time, according to the sign of the filter coefficients. The new concept is depicted in Figure 1, where a second order UWB analog FIR filter is shown.

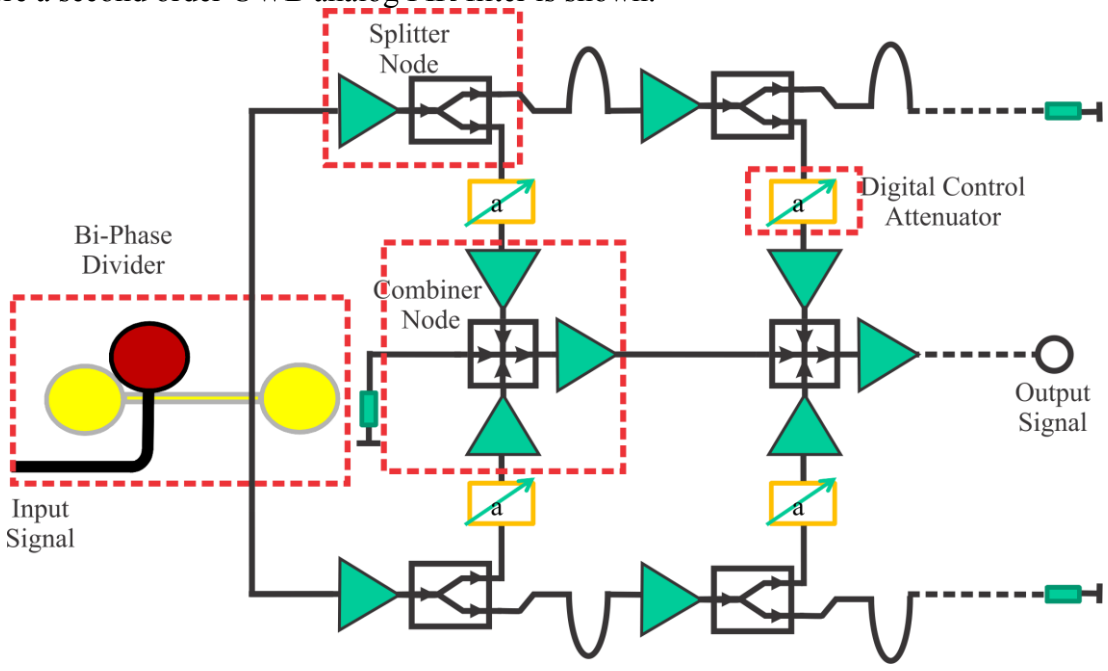

Figure 1 Implementation of UWB Analog FIR-Filter

After presenting the concept in details we will provides details of measurements for each filter component and finally present measurements for a complete filter tap. In a companion paper, we present some applications based on the achieved measurement results.