Pipelined FIR Filter

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Finite Impulse Response (FIR) filters are a type of digital filter widely used in signal processing due to their simplicity, stability, and flexibility.

Key Characteristics of FIR Filters

1. **Finite Impulse Response:**
   - The term "finite impulse response" indicates that the filter's impulse response settles to zero in a finite amount of time. This is because FIR filters do not have feedback loops, so the output is entirely based on a finite number of input samples.
2. **Linear Phase Response:**
   - FIR filters can be designed to have a linear phase response, which means they preserve the phase relationships of the frequency components of the signal. This is important in applications like audio processing, where phase distortion is undesirable.
3. **Stability:**
   - FIR filters are inherently stable because they lack feedback. The output depends only on current and past input values.
4. **Flexibility:**
   - FIR filters can be designed to approximate almost any frequency response, making them suitable for a wide range of applications.

An FIR filter processes an input signal using the following equation:

$$\text{What is the output } y[n] \text{ of the system defined as } y[n] = \sum_{k=0}^{N-1} h[k] \cdot x[n-k]$$

Project explanation

At this stage of the project, we aim to implement the FIR filter using two methods in a pipelined architecture. The method we are utilizing in this project is known as the "Cutset Method" (Cutset Structure), where registers are placed along the pipeline paths. Figure 1 illustrates the pipelined implementation of this filter.

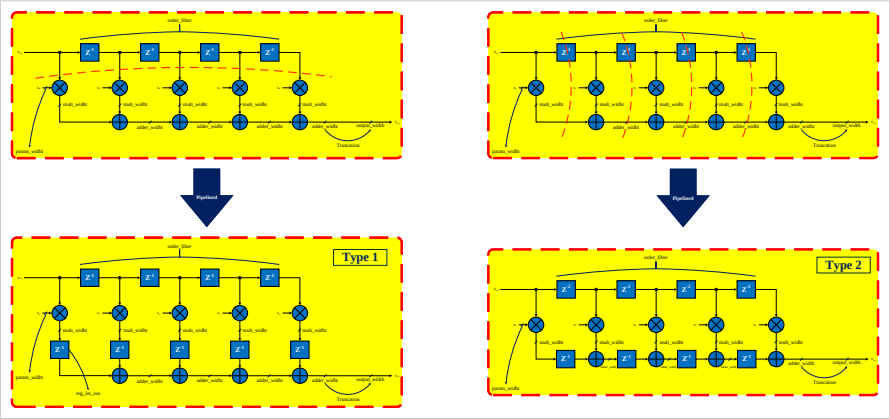

Figure 1: *FIR Filter*

This filter is defined parametrically, allowing its order to be adjusted by modifying its parameters.

Figure 2 illustrates the step response of the filter's output.

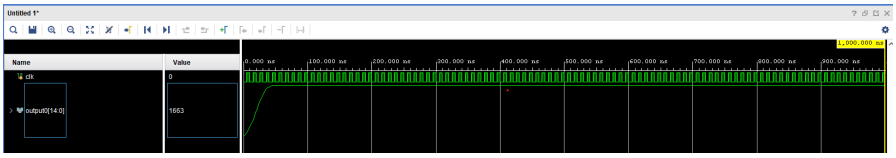

Figure 2: *Step response*