Lab Activity 0

ELEC 4601, Digital and Embedded System Design, Session 2 2018

Task Description

Consider a 16-tap FIR filter with the input-output relationship

$$y(n) = \sum_{k=0}^{15} a_k x(n-k),$$

where the filter coefficients are given as
$a_0 = -0.0024$, $a_1 = -0.0042$, $a_2 = 0.0095$, $a_3 = 0.0200$,
$a_4 = -0.0380$, $a_5 = -0.0696$, $a_6 = 0.1374$, $a_7 = 0.4472$,
$a_8 = 0.4472$, $a_9 = 0.1374$, $a_{10} = -0.0696$ $a_{11} = -0.0380$,
$a_{12} = 0.0200$, $a_{13} = 0.0095$, $a_{14} = -0.0042$, $a_{15} = -0.0024$.

(i) Implement the above filter using the direct-form I structure. Your lab demonstrators will guide you to show the detailed steps in doing this using the Matlab/Vivado tools. Once the design is created, compute the impulse response $h_{sim}(n)$ of the filter from your design and use that to compute the magnitude frequency response $\left|H_{sim}(e^{j\omega})\right|$. Verify the functionality of the design by comparing $\left|H_{sim}(e^{j\omega})\right|$ to the ideal response $\left|H(e^{j\omega})\right|$ computed in Matlab. Use a suitable fixed-point word length of your choice. Once the functionality of the design is verified, perform the synthesis and implementation of your design using the tools and obtain the area, critical path, and speed performance of your design. You do not need to perform a hardware co-simulation on the FPGA for this lab.

(ii) Now implement the same filter in the data broadcast structure and verify its functionality and obtain the area, critical path, and speed performance and compare with the results in (i).

Submit a 1-2 page document[1] summarising your results and drawing any conclusions. You may include screenshots from the software, however, a summary of performance figures should be presented in text or table format. You should print your name, student ID on this problem sheet, get this sheet signed by one of the lab demonstrators and attached as the front page of your report. 1-2 page count is excluding this front-page. **Report due date is 27/08/2018 in hardcopy**.

Student Name:

Student ID:

Lab demonstrator signature:

[1] It is recommended that you use IEEE document format but with single column instead of double columns. https://www.ieee.org/conferences/publishing/templates.html