

Seth Pregler  
ECEN 489-508  
02.21.22

## Lab 4 Pre-lab Submission

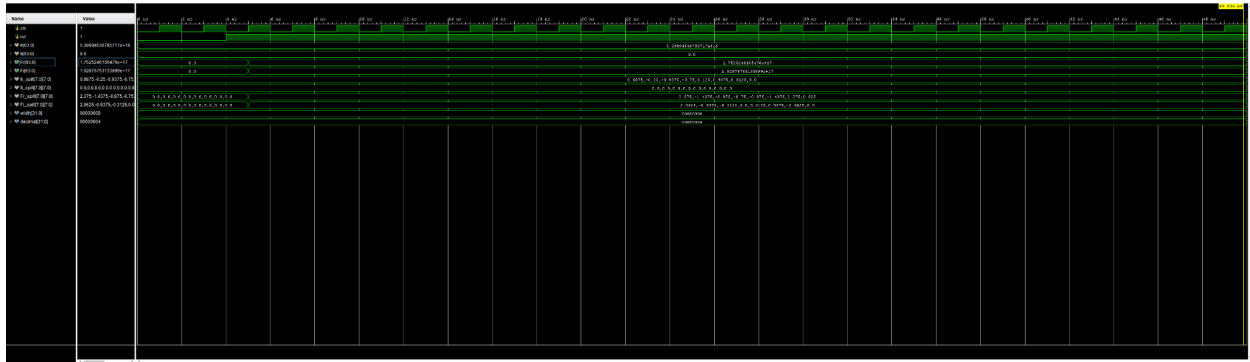


Figure 1 - Behavior Simulation of Radix-2 Decimation in Time FFT

Figure 1 shown above, displays the behavioral simulation for the radix-2 decimation in time FFT. In the testbench, we pass as input a series of points from a discrete Sine wave. The result is a series of Fourier coefficients with both a real and imaginary part. The figure below shows the output of the simulation; the top row contains the real part while the bottom row contains the imaginary part of the Fourier coefficients.

2.375,	-1.4375,	-0.875,	-0.75,	-0.875,	-1.4375,	2.375,	0.625
2.0625,	-0.9375,	-0.3125,	0.0,	0.3125,	0.9375,	-2.0625,	0.0

Figure 2 - Fourier Coefficients: Real (Top) and Imaginary (Bottom)

Lastly, I verified the results from the behavioral simulation with the outputs generated from the Matlab test file. The image below displays this output; the first column is the Fourier coefficients and begins with  $F_0$  at the top and ends with  $F_7$  at the bottom. Our results are within the error threshold of 0.1 so we can conclude that the implementation was a success. Note that this error is due to the limited number of bits used in our computation.

MATLAB R2021b - academic use

	1	2	3	4	5	6	7
1	0.5537 + 0.0000i	4.0000 + 0.0000i	4.0000 + 0.0000i				
2	2.3946 - 2.0970i	1.0000 - 2.4142i	-1.7071 + 0.0000i				
3	-1.3867 + 0.9156i	0.0000 + 0.0000i	0.0000 + 0.0000i				
4	-0.8810 + 0.2804i	1.0000 - 0.4142i	-0.2929 + 0.0000i				
5	-0.8076 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i				
6	-0.8810 + 0.2804i	1.0000 + 0.4142i	-0.2929 + 0.0000i				
7	-1.3867 - 0.9156i	0.0000 + 0.0000i	0.0000 + 0.0000i				
8	2.3946 + 2.0970i	1.0000 + 2.4142i	-1.7071 - 0.0000i				

Figure 3 - Output of Matlab Test