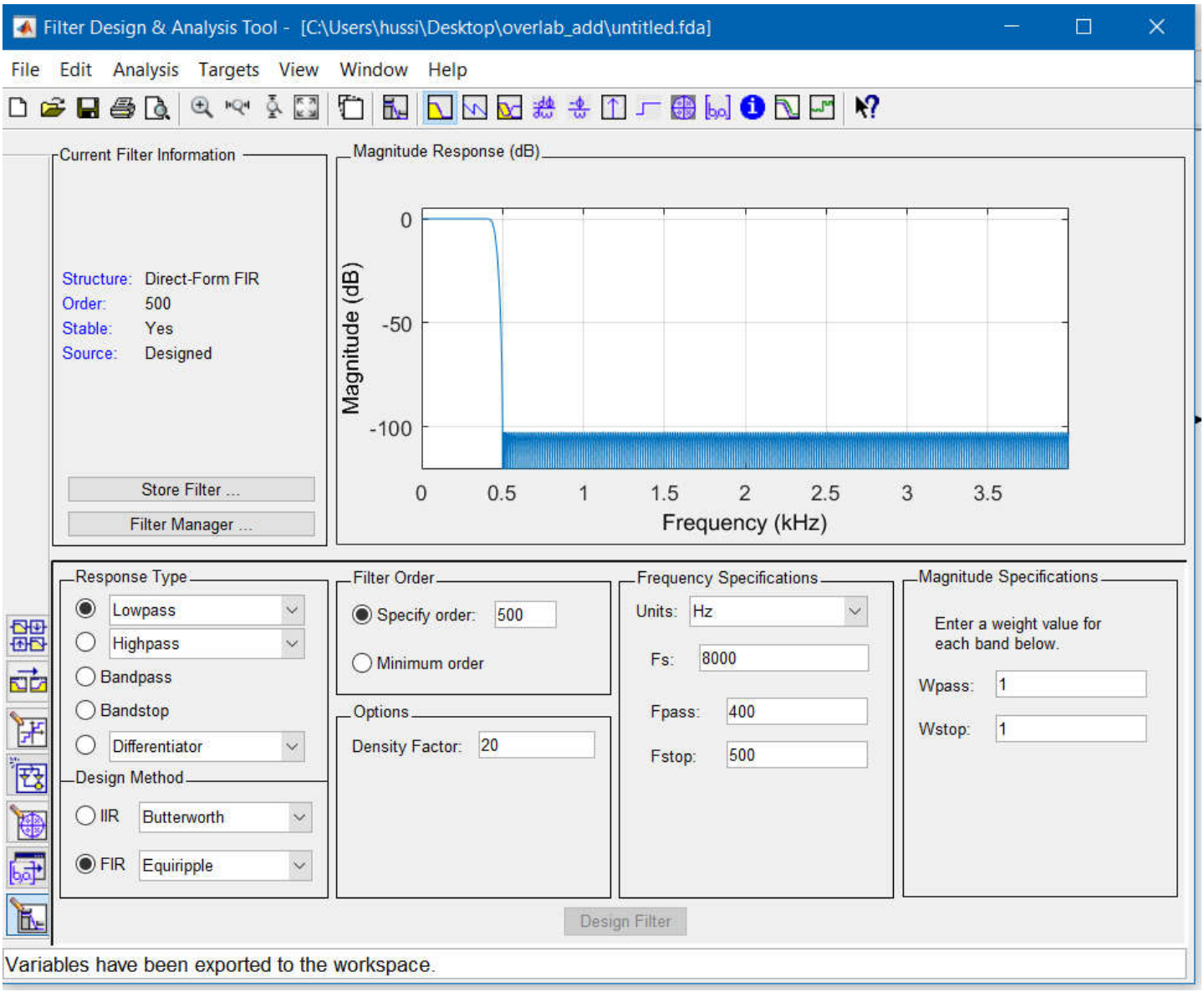
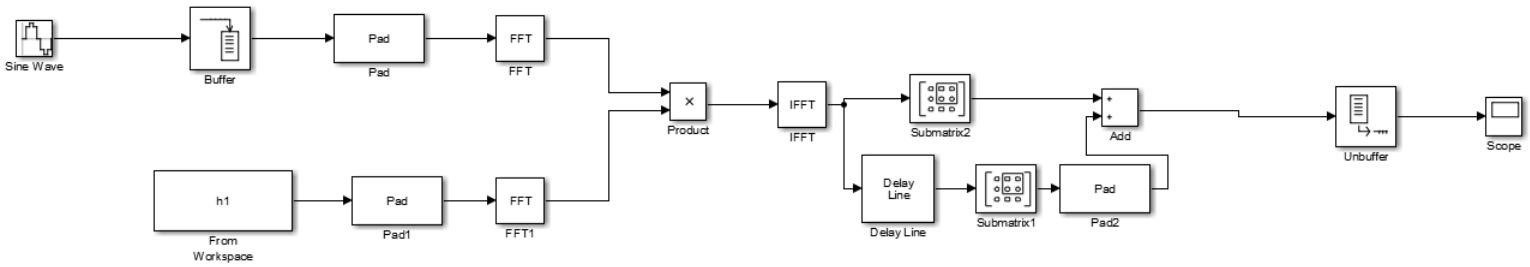
Overlap-add:

Filter coefficients:

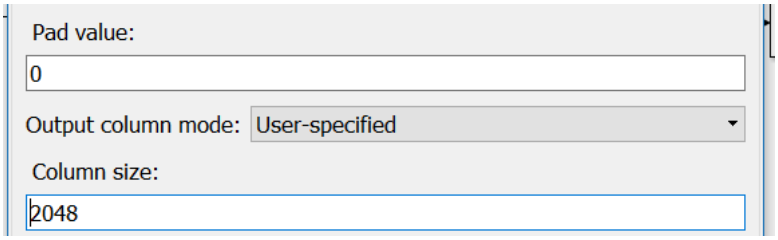


Overlap-add implementation:

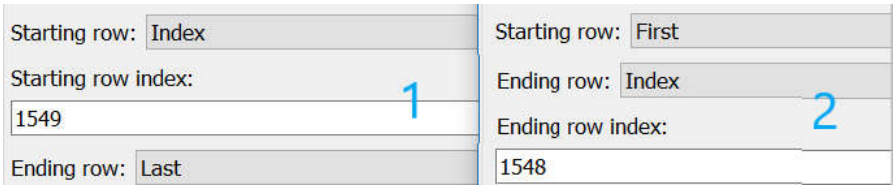


Walkthrough:

- Converting the input signal into blocks with the “Buffer”, length of block =1548 “L”
- Hence size of FFT = L+M-1 which = 2048, we will add padding for both the block and the filter “h1”.



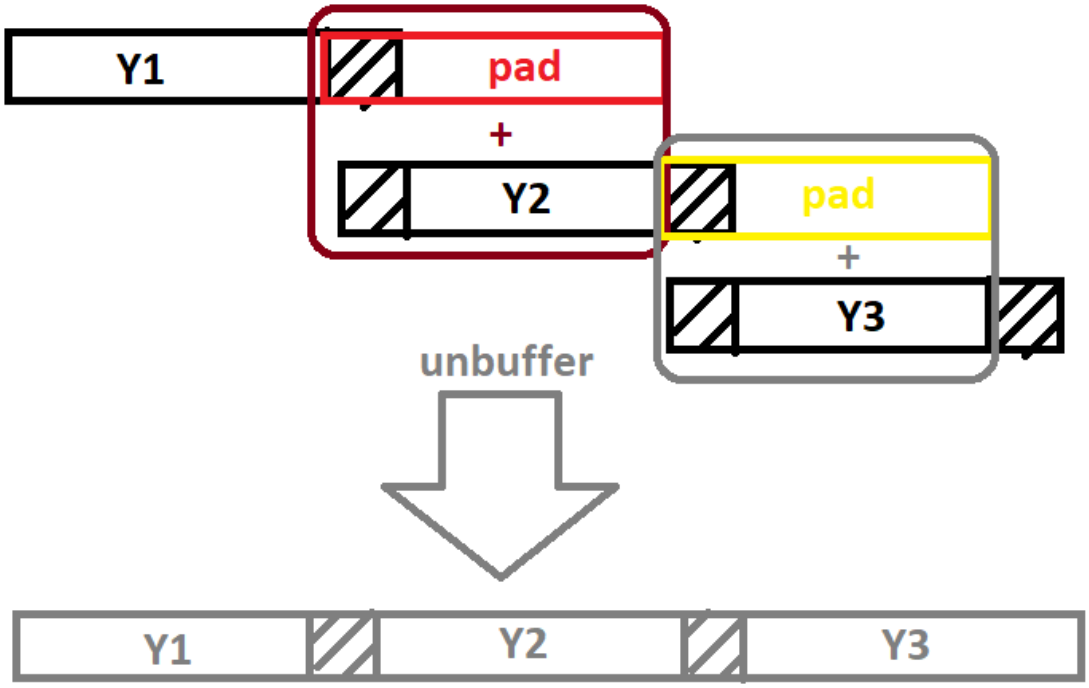
- Now we can make FFT for each “the signal and the filter” then we can multiply outputs with the product block.
- This is the output of a block of the signal convoluted with the filter.
- To return the output to time domain we use “IFFT Block”.
- We want to add the blocks together to retrieve the desired output of the whole signal rather than blocks of the signal.
- Using the submatrix blocks with these parameters:



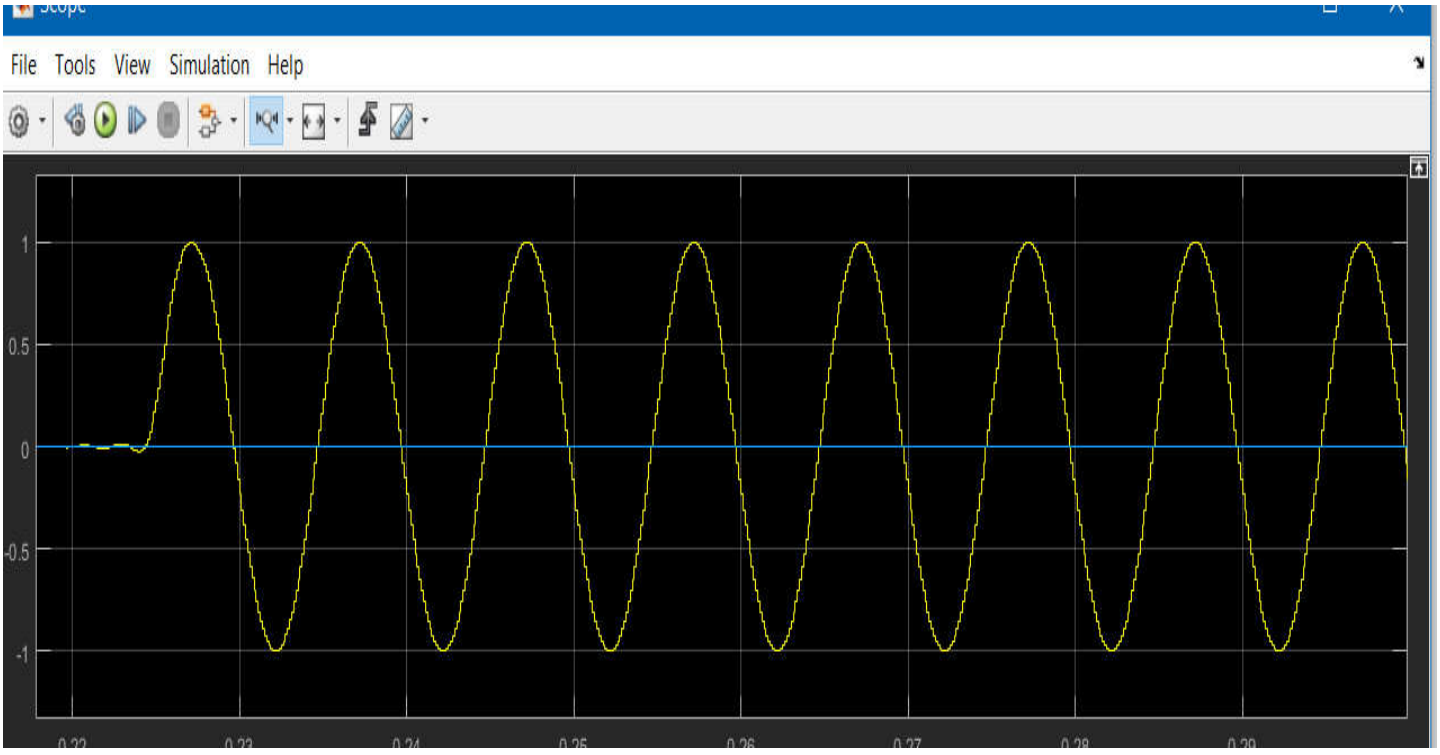
- Submatrix-1 size = 500, Submatrix-2 size = 1548.

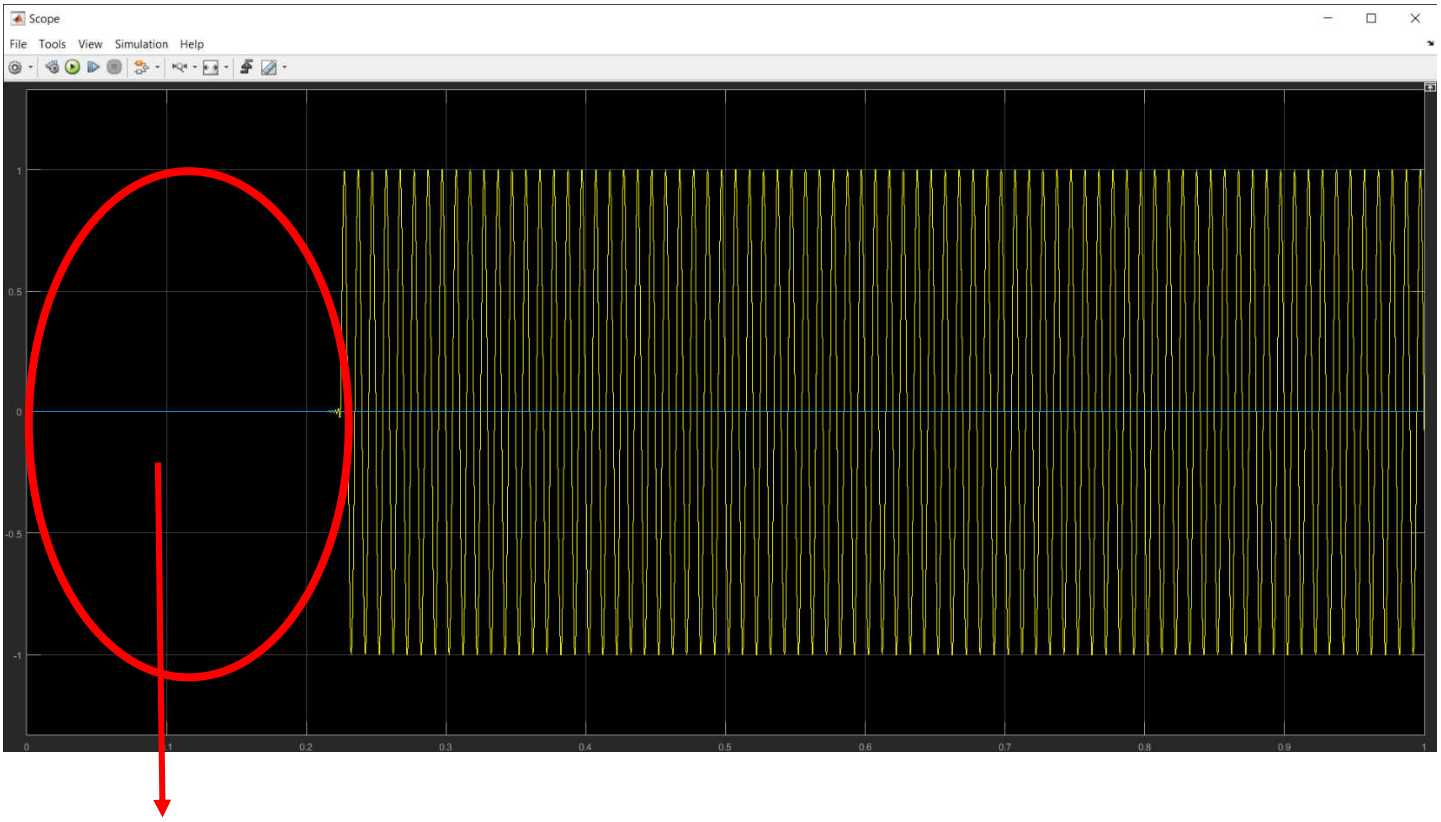
To achieve the overlap-add algorithm:

- we add delay block before “submatrix-1” and delay size = 2048
- padding submatrix-1 to have same length as submatrix-2
- Hence, they have same size now we can add them.
- “Unbuffer block “: converts it into a sample-based signal (the original format of the input)
- Then we can view output with “scope block”


Y1
pad
+
Y2
pad
+
Y3
unbuffer
Y1
Y2
Y3

Output:

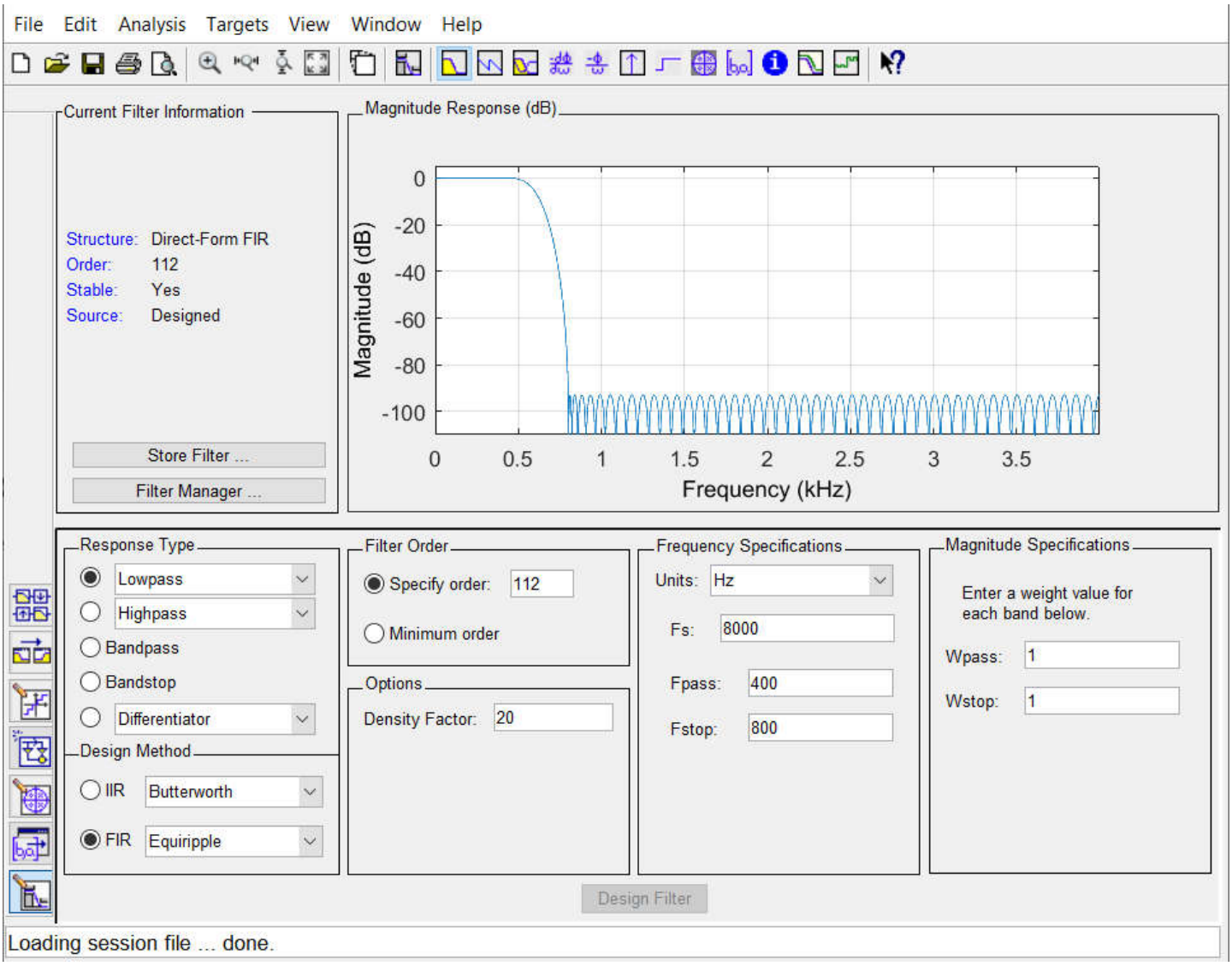

File Tools View Simulation Help
1
0.5
0
-0.5
-1



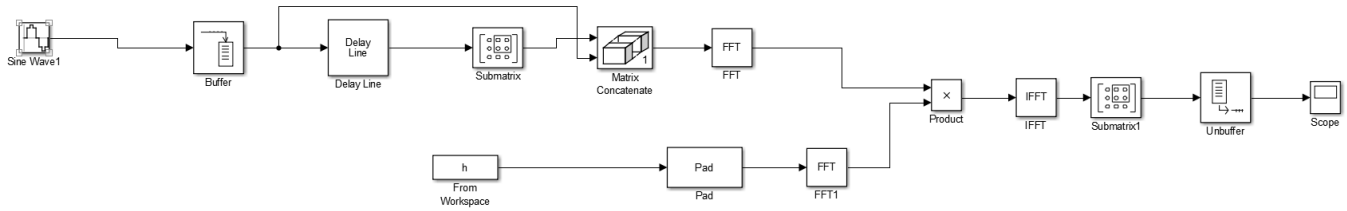
Delay due to the operations

Overlap-save:

Filter coefficients:

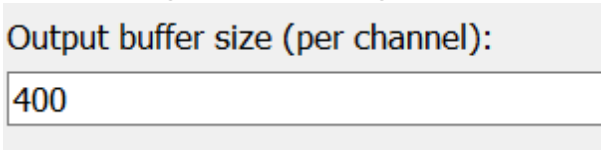


Overlap-save implementation:

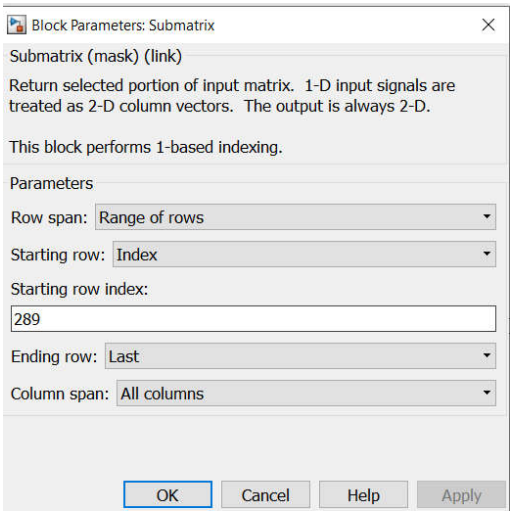


Walkthrough:

- Converting the input signal into blocks with the “Buffer”, length of block =400 “L”



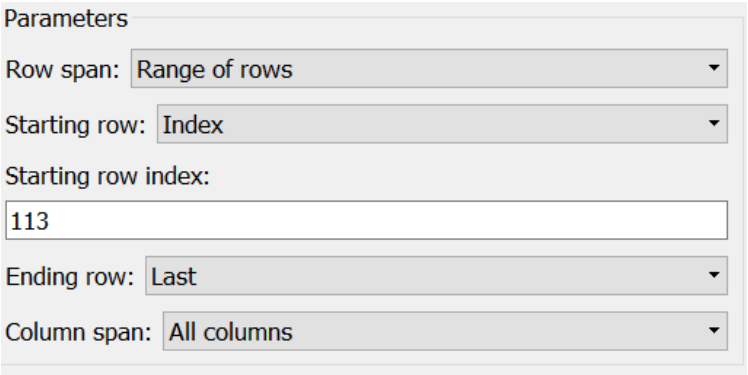
- We will delay every block of “L” size using “delay line block”
- We can choose last M-1 elements using submatrix block and append them to the first of next block.



- Then we concatenate padding output with buffer block to have length of 512
- On the other side we add padding to the filter coefficients matrix to be the same size of the concatenated matrix we had.
- We will make FFT to the two matrices then get the product of them.
- We will operate IFFT to the result to return it to time domain.

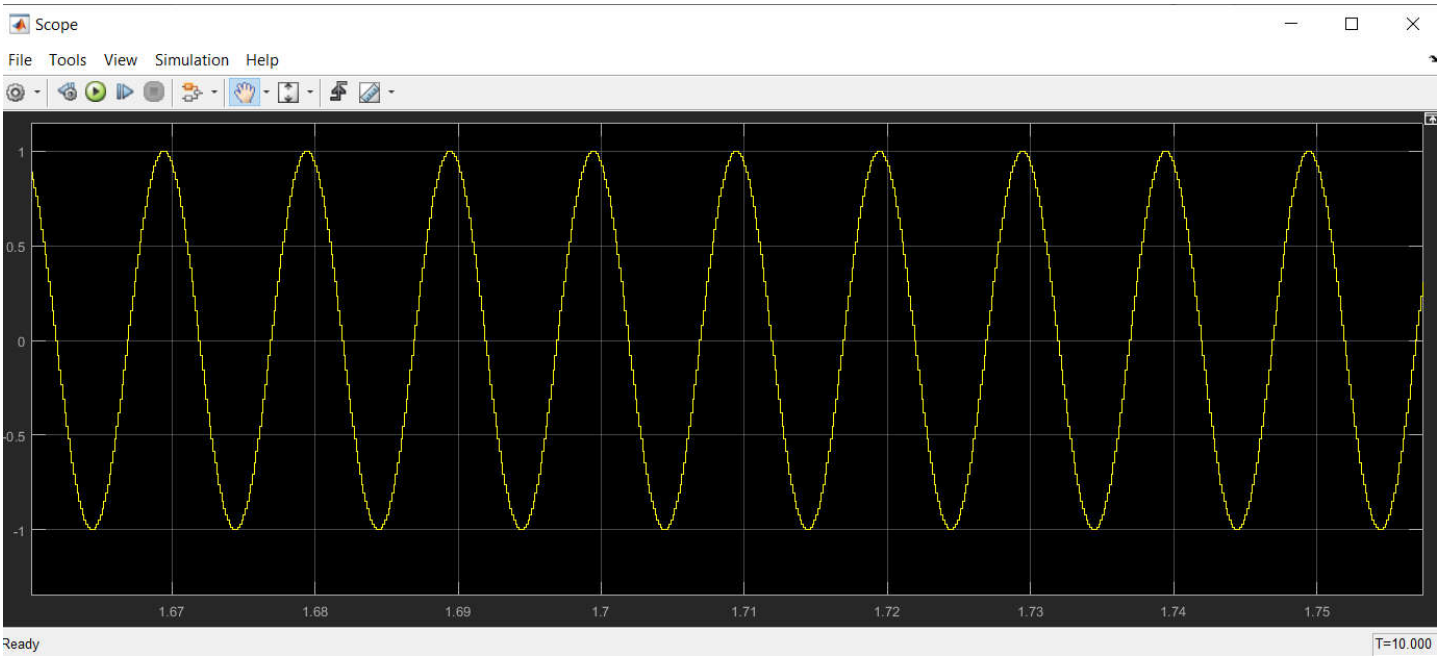
To achieve the overlap-save algorithm:

- We will remove M-1 elements from the first of every block using submatrix block.



- Then we Unbuffer the result signal and display it on the scope.

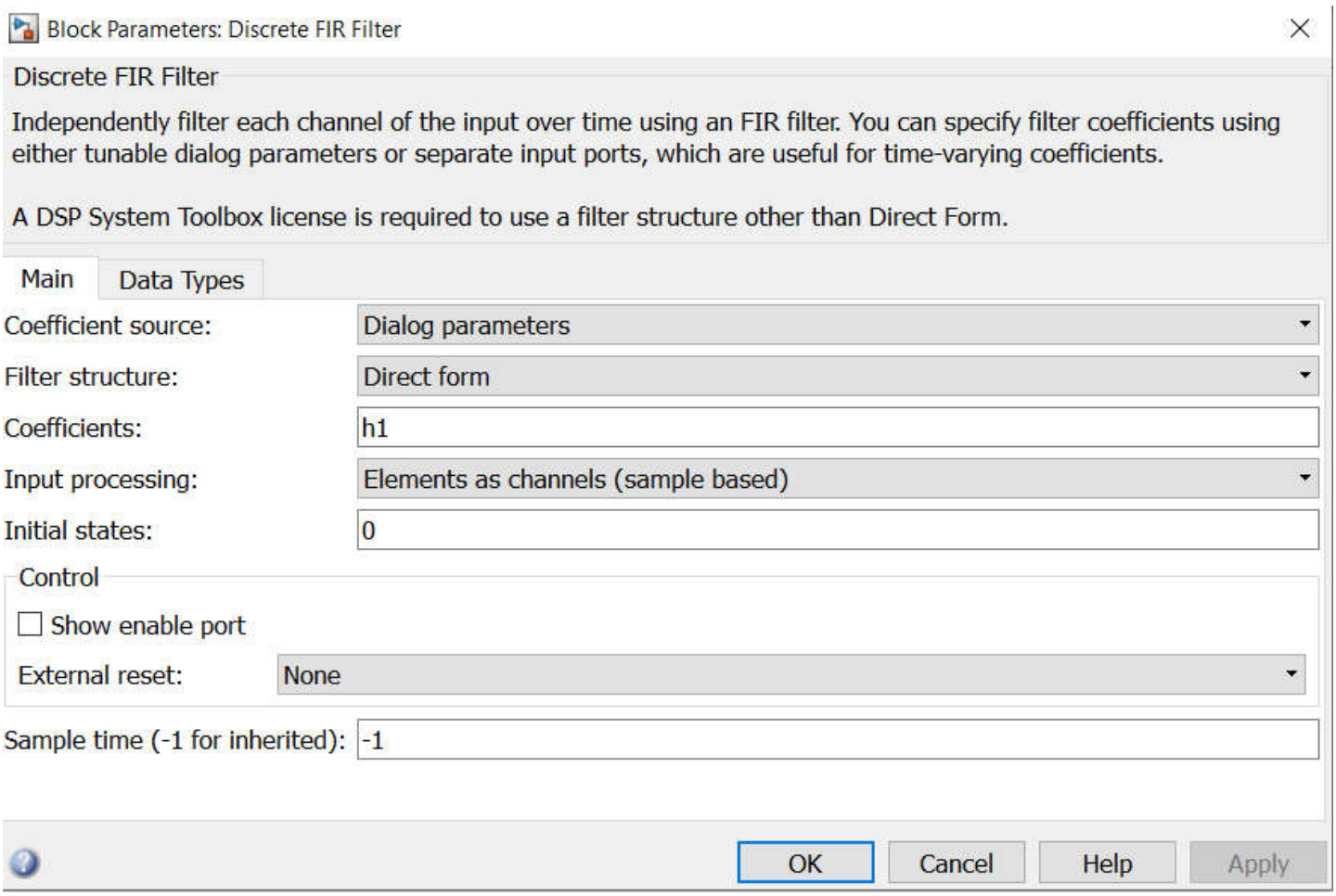
Output:



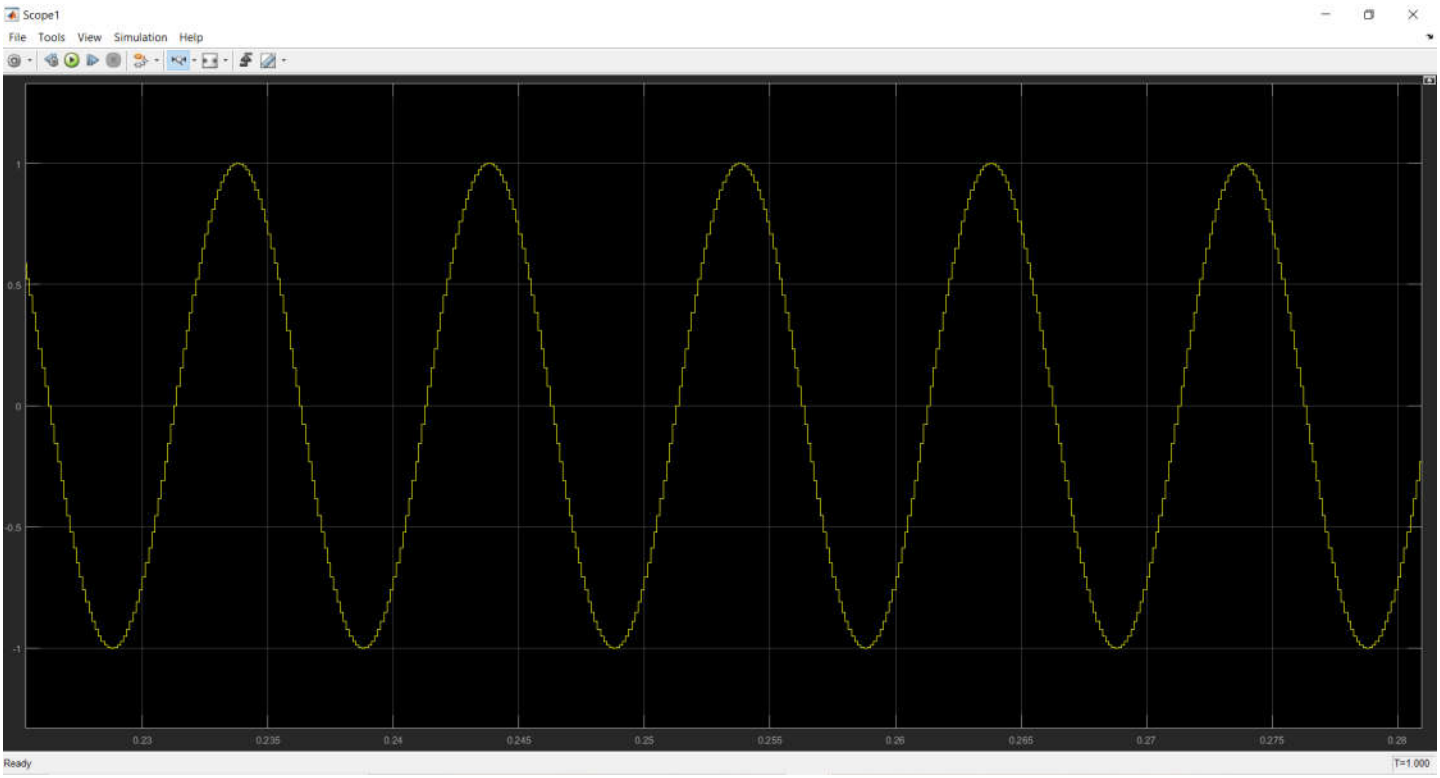
Linear Convolution: (We used 2 methods)

*First Method: Discrete FIR Filter

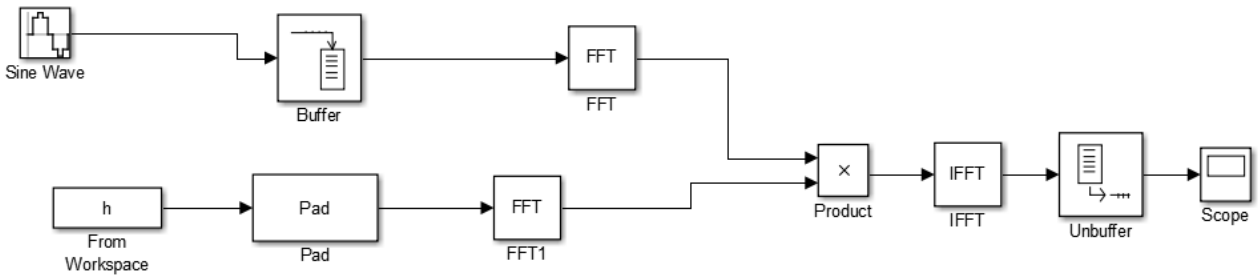
- This block will make linear Convolution Between the input signal and the filter coefficients (for this example we used coefficients of overlap-add).



Output:

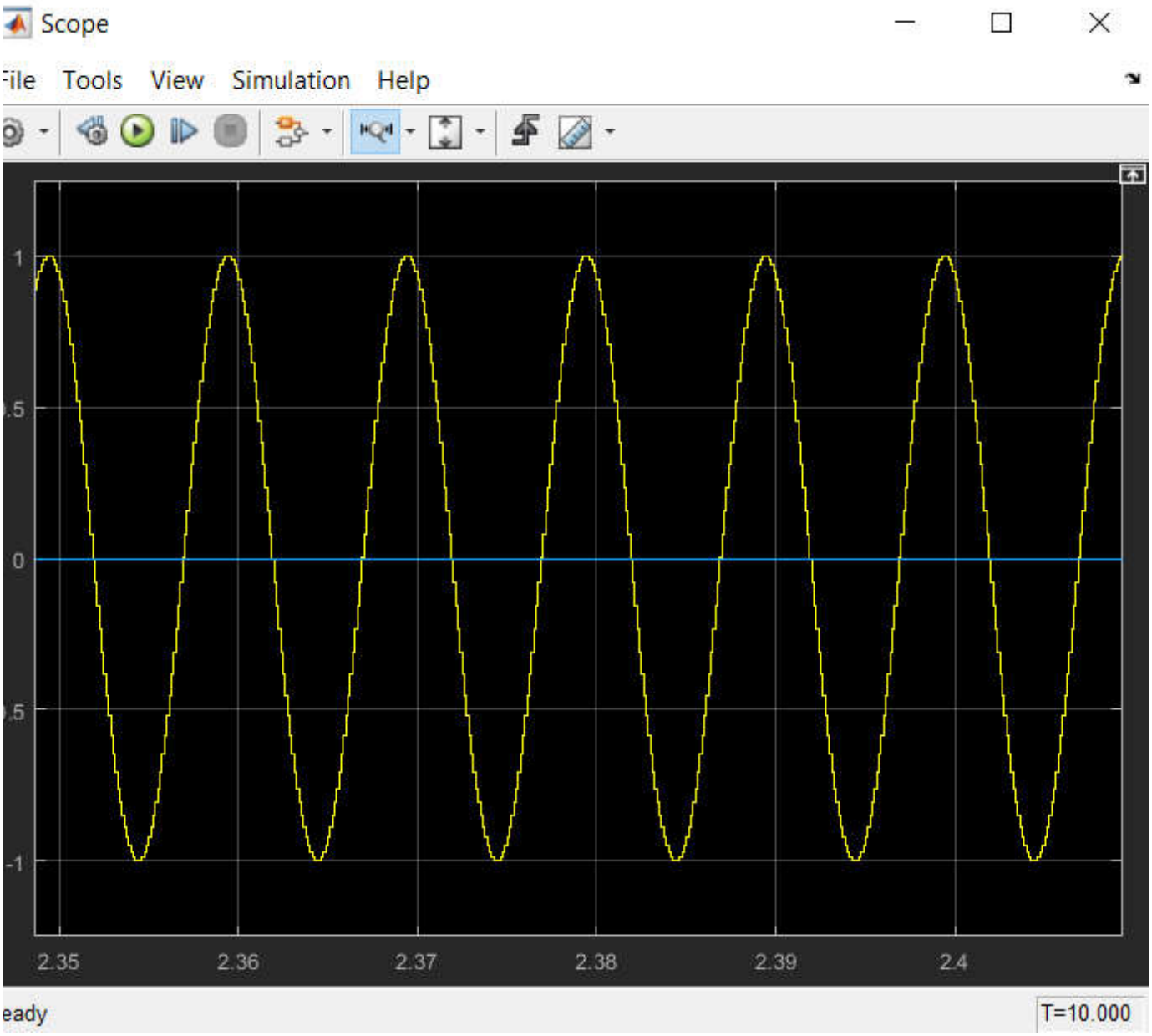


*Second Method:



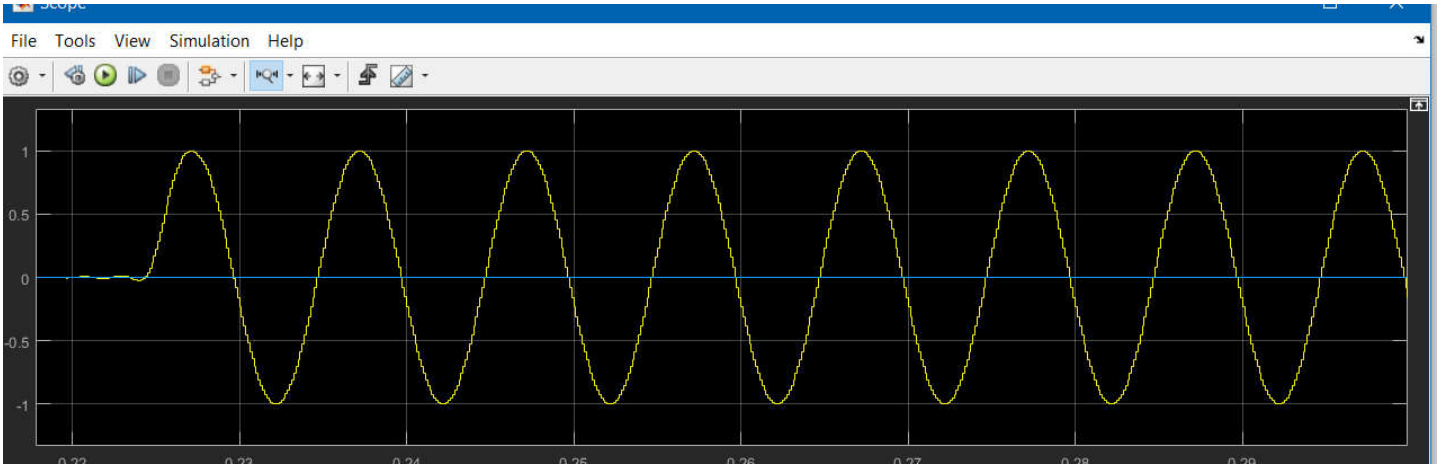
- We will convert the input signal into blocks of length 400 using buffer block then operate FFT on them.
- On the other side we will add padding filter coefficients (we used Overlap-save coefficients in this example) to make its size 400 then operate FFT on it too.
- We get the product of the 2 matrices then operate IFFT to return to time domain.
- Then we Unbuffer the result signal and display it on the scope block.

Output:

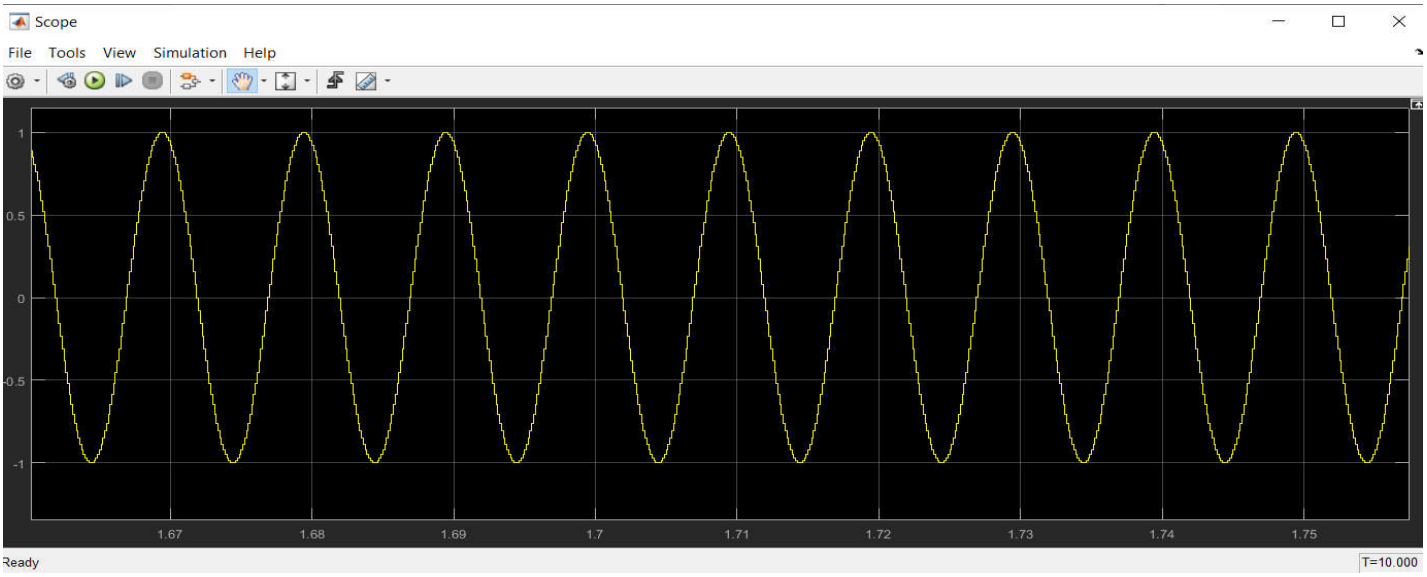

Scope
File Tools View Simulation Help
1
.5
0
.5
-1
2.35
2.36
2.37
2.38
2.39
2.4
eady
T=10.000

Comparing Overlap-add, Overlap-save and Linear Conv. Outputs:

*Overlap-add:



*Overlap-save:



Linear Conv. (the two methods):