

demo 08

Name: Sagar Patel

NETID: sp5894

Question 07:

In the demo program `echo_via_circular_buffer.py`, change the line `buffer[k] = x0` to `buffer[k] = y0` and comment on how this affects the sound of the output. With this change, what is the difference equation, transfer function, and impulse response of the system?

What happens when the gain for the delayed value is greater than 1?

Answer:

Difference Equation and Transfer Function

Given,

$$G = 0.8, b_0 = 1, N = 800$$

$$y(n) = b_0 \cdot x(n) + G \cdot y(n - N)$$

Substituting the values of G , b_0 and N ,

$$\Rightarrow y(n) = x(n) + 0.8y(n - 800)$$

Taking Z-transformation, we get -

$$\Rightarrow Y(Z) = X(Z) + 0.8Z^{-800}Y(Z)$$

$$\therefore H(Z) = \frac{1}{1 - 0.8Z^{-800}}$$

Observations

1. Upon changing the value of `buffer[k]` to `y0`, the result of the filter is fed as the echo. This leads to a more distant echo as compared to using the input as the buffer.
2. When the gain for the delayed value is greater than 1, the echo gets louder than the original input and the resulting wave is entirely distorted.

Impulse Response

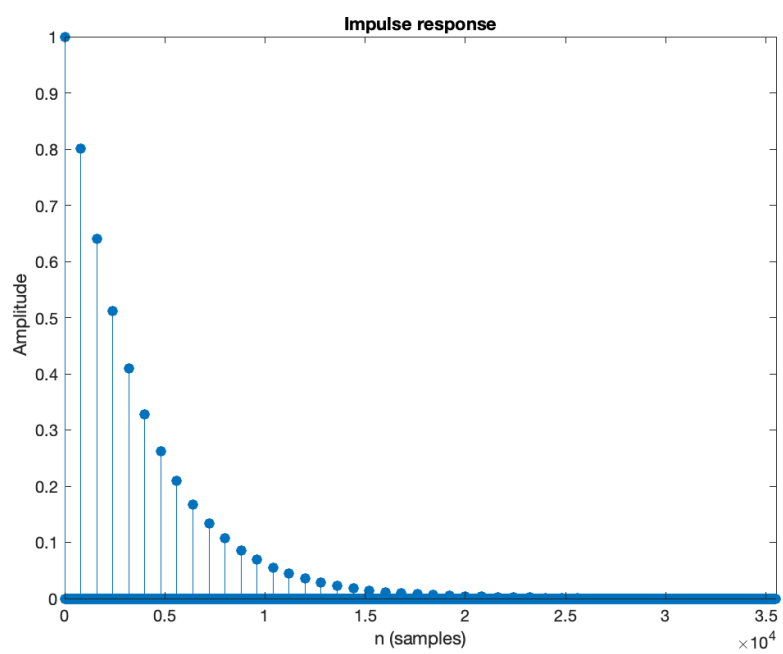


Figure 1: Impulse Response