

Laboratory 9

Electronics Engineering 3210

Discrete Time System Response

Purpose:

This lab allows students to investigate the response of a discrete time system to various inputs, first by calculating the response in the time domain, then by multiplying the z-transform of the signal by the transfer function of the system in the frequency domain. Students will verify these results by experiment.

Preliminary:

Write a title and short description of this lab on a new page of your lab book. Make an entry in the table of contents for this lab.

Consider a system defined by the equation:

$$(E^2 + 0.15E - 0.76)y_k = (E - 0.25)f_k$$

Part I – Time Domain (Iterative) Solution.

Find the difference equation for this system and record it in your lab book. Write a MATLAB script that uses the difference equation to find and plot y_k for $0 \leq k \leq 100$. Assume $y_{-n} = 0$ for $n > 0$ and $f_k = u_k$. Make sure to label your axes.

Part II – Frequency Domain (Closed Form) Solution.

Find the transfer function, $H(z) = P(z)/Q(z)$ and record it in your log book.

Find the z-transform, $F(z)$, of the input signal, f_k . Record that as well.

Compute $Y(z) = F(z) H(z)$ and find its inverse z-transform, y_k . Record these expressions too.

Modify your MATLAB script to compute and plot the y_k you computed above.

Procedure:

Run your MATLAB script. Verify that the two graphs it produces are identical, then affix copies to your lab book.

Repeat the entire procedure for $f_k = (0.98)^k u_k$.

Record your observations and write a conclusion in your lab book that summarizes what you have observed or discovered.