National Institute of Technology Calicut

Department of Electronics and Communication Engineering

EC 3093D DIGITAL SIGNAL PROCESSING LAB

Sixth Semester B Tech Electronics & Communication Engineering

Experiment 3: FFT(DIT and DIF) algorithm and Z transform implementation .

Note: All the experiments must be implemented in both Matlab and Python.

1. Write a program to implement FFT (DIT and DIF) algorithm for a finite duration signal, x[n].
2. Z Transform
   (a) Write a program to compute and display the poles and zeros, to compute and display the factored form, and to generate the pole-zero plot of a z- transform that is a ratio of two polynomials in z^{-1}.Using this program, analyze the z transform.
   (b) from the pole-zero plot generated in part a, determine the possible ROCs? Can you tell from the pole-zero plot whether or not the DTFT exists? Is the filter stable if it is causal?
   (c) Using zp2tf, determine the rational form of a z transform whose zeros are at $\xi_1 = 0.3, \xi_2 = 2.5, \xi_3 = -0.2 + j0.4, \xi_4 = -0.2 - j0.4$;the poles are at $\lambda_1 = 0.5, \lambda_2 = -0.75, \lambda_3 = 0.6 + j0.7, \lambda_4 = 0.6 - j0.7$; and the gain constant k is 3.9.
   (d) using impz() determine the first 10 samples of the inverse Z transform of $X(z) = \frac{z^{-1}}{3-4z^{-1}+z^{-2}}$
   Using residuez obtain the partial fraction expansion of X(z) .From the partial fraction expansion,write down the closed form expression of the inverse Z transform (assuming causal).evaluate the first 10 samples of the closed form expression for x[n] and compare with the result obtained using impz

(e) Using residues convert back the partial fraction expression for X(z) in part d to the rational function form

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