



COMPARISON OF PARAMETERS OF EXPONENTIAL SIGNAL USING DFT AND INTERPOLATED DFT ALGORITHM

Prof..P.V. Ambatkar, Prof.S.V. Kawre , Prof.R.P.Shirsat , Prof. A.Narwadkar

Abstract—

Distinct Fourier rework (DFT) is maybe the foremost standard signal process tool. Wide DFT use is partially dedicated to quick Fourier rework (FFT) algorithms (Cooley & Tukey, 1965, Oppenheim et al., 1999, Lyons, 2004). DFT can also be with efficiency computed by algorithmic algorithms within the window slippy by one sample (Jacobsen & Lyons, 2003, Duda, 2010). sadly, DFT has 2 main drawbacks that deteriorate signal analysis that square measure (Harris, 1978, Oppenheim et al., 1999): 1) spectral run, and 2) sampling of the continual spectrum of the distinct signal. Spectral run is reduced by correct time windows, and also the frequency bins between DFT bins square measure computed by interpolated DFT(IpDFT) algorithms, totally given during this paper..

Keywords —DFT, IpDFT, FFT, DFT.

INTRODUCTION

Discrete Fourier rework (DFT) is maybe the foremost standard signal process tool. Wide DFT use is partially dedicated to quick Fourier rework (FFT) algorithmic program. sadly, DFT has 2 main drawbacks that deteriorate signal analysis that square measure 1) spectral run, and 2) sampling of the continual spectrum of the distinct signal. Spectral run is reduced by correct time windows, and also the frequency bins between DFT bins square measure computed by interpolated DFT (IpDFT) algorithms.

DFT ANALYSIS

If you're victimization Word, use either the Microsoft Equation Editor or the MathType add-on (<http://www.mathtype.com>) for equations in your paper (Insert | Object | produce New | Microsoft Equation or science kind Equation). "Float over text" shouldn't be hand-picked. Fourier rework (FT) of infinite length distinct signaling X_n is outlined as

$$X(e^{j\omega}) = \sum_{n=-\infty}^{\infty} X_n e^{-j\omega n} \quad (1)$$

where n is number sample index that goes from minus to and eternity and ω is continuous frequency in radians (angular frequency, pulsation). Continuous spectrum $X(e^{j\omega})$ outlined by (4) is periodic with the amount 2π . The notation $X(e^{j\omega})$ rather than $X(\omega)$, stresses up the association between foot and Z rework. For finite length distinct signaling v_n containing N samples DFT is outlined as

$$V_k = \sum_{n=0}^{N-1} v_n e^{j(2\pi/N)kn}. \quad (2)$$

From it's seen, that by DFT the foot spectrum is computed just for frequencies $\omega_k=(2\pi/N)k$, that's DFT samples continuous spectrum of the distinct signal. Finite length signal $v_n, n=0,1,2,\dots,N-1$ is obtained from infinite length signal $x_n, n=\dots-2, -1,0,1,2,\dots$ by windowing, that's by multiplication with distinct signal w_n , referred to as window, with nonzero values solely on positions $n=0,1,2,\dots,N-1$

$$V_n = .X_n \tag{3}$$

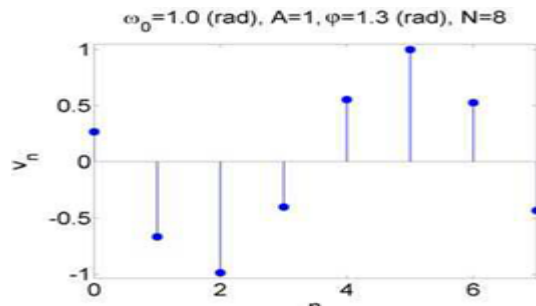
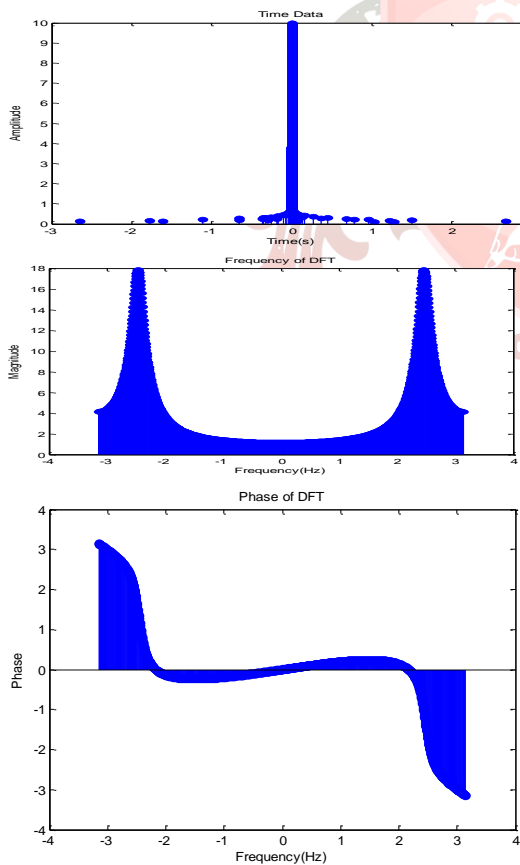
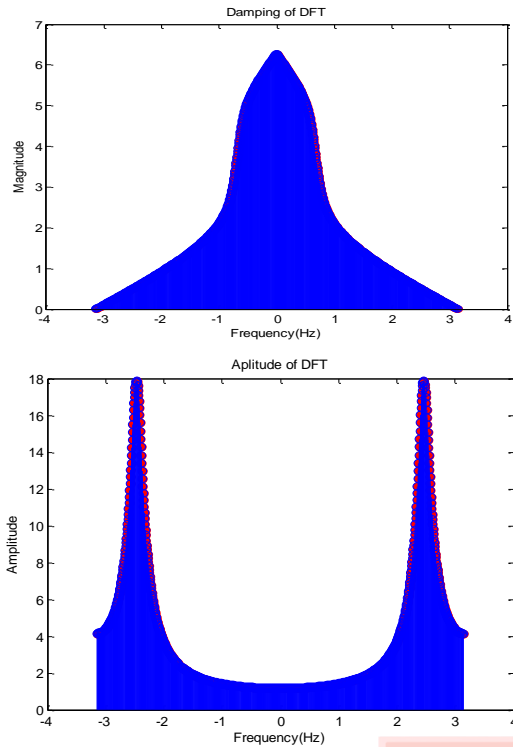


Fig. 1 illustrates equations given above for sinusoidal signal (1) analyzed with rectangular window for $A=1, \omega_0=1 \text{ rad}, \phi=1.3 \text{ rad}$, and $N=8$.

Result obtained from operation done victimization committal to writing associated with DFT algorithmic program square measure shown below victimization some diagrams





I. INTERPOLATED DFT ALGORITHMS

The IpDFT downside for curving and damped curving signals is portrayed and will be developed as follows. supported the DFT spectrum V_k (5) of the signal x analyzed with the glorious window w_n , find the frequency correction δ thus to satisfy the equation

$$\omega_0 = (k \pm \delta) \frac{2\pi}{N}, 0 < \delta \leq 0.5 \quad (3)$$

where ω_0 is signal's frequency, N is that the variety of samples and k is that the index of DFT bin with the best magnitude. If $|V_{k+1}| > |V_{k-1}|$, as in Fig. then there is '+'.
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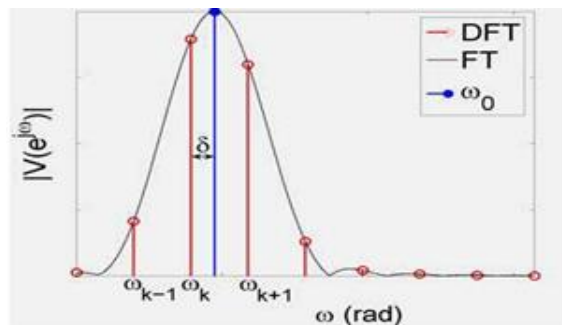
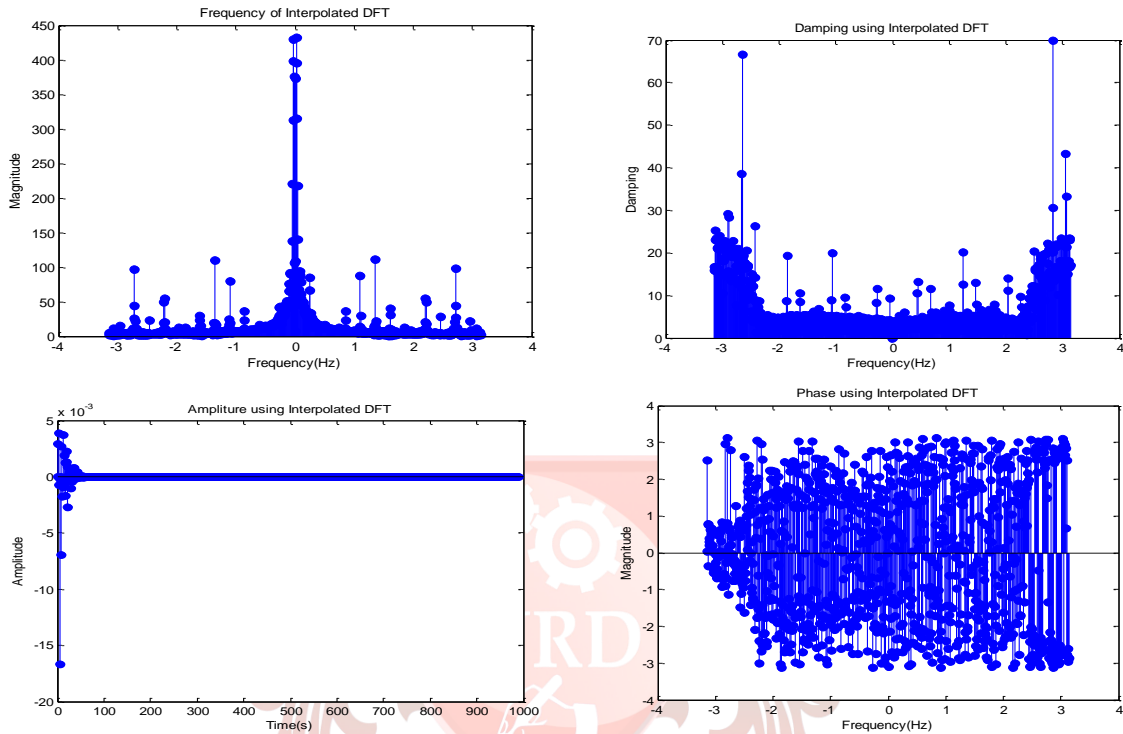


Fig.2. Illustration of IpDFT problem; $\omega_{k-1}, \omega_k, \omega_{k+1}$ frequencies of DFT bins ω_0 - signal's frequency, δ - frequency correction.

Result obtained from operation done victimization committal to writing associated with interpolated DFT algorithmic program square measure shown below victimization some diagrams



V. CONCLUSION

This paper describes DFT interpolation algorithms for parameters estimation of curving and damped curving signals. IpDFT algorithms have 2 main advantages:

1. Low procedure complexness attributed to quick algorithms of DFT computation.
2. No want for the signal model (as hostile constant methods).

IpDFT ways is also used as totally purposeful estimators, particularly once noise disturbance isn't terribly sturdy. If the signal model is thought IpDFT is also used for providing place to begin for LS optimisation that's optimum for Gaussian zero-mean noise disturbance. For the signals with disturbances impracticable to incorporate within the signal model, as e.g. unknown drift, IpDFT with adequate time window might provide higher performance than optimisation.

Calculated results are like this:

Amplitude_dft	Frequency_dft	Damping -dft	Phase_dft
15.4558	61.548	10.9592	1.4878

Amplitude-idft	Frequency_idft	Damping-idft	Phase_idft
14.771	60.462	10.341	0.7845

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