APPENDIX - I

The Spectral Observer may operate with any sampling interval Δt. In general, $2N + 1$ samples are required for convergence to determine the harmonic contents of the band-limited signal $y(t)$. A general method of gain coefficient calculation is to temporarily transform the system to the dual of the phase variable canonical form [5, 6, 7, 8]

$$\xi' = Q\xi$$

$$\xi'(k+1) = (Q \phi \bar{Q}^{1})\ \xi'(k) + Q\, g[y - C^{T} \bar{Q}^{1}\ \xi'(k)]$$

$$\gamma(k) = (C^{T} \bar{Q}^{1})\ \xi'(k)$$

where

$$\phi' = Q \phi \bar{Q}^{1} = \begin{bmatrix} p_1 & 1 & 0 & \cdots & 0 \\ p_2 & 0 & 1 & \cdots & 0 \\ p_3 & 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & & \vdots \\ p_{2N} & 0 & 0 & \cdots & 1 \\ p_{2N+1} & 0 & 0 & \cdots & 0 \end{bmatrix}$$

$$C'^{T} = C^{T} \bar{Q}^{1} = [1 \quad 0 \quad 0 \cdots 0]$$

$$g' = Qg = [g_1' \quad g_2' \cdots\cdots g_{2N+1}']^{T}$$

The characteristic equation of ϕ' is easily shown to be

$$z^{2N+1} - p_1 z^{2N} - p_2 z^{2N-1} \ldots\ldots - p_{2N} z - p_{2N+1} = 0$$

The characteristic equation of the transformed system is

$$z^{2N+1} - (p_1 - g_1')z^{2N} - (p_2 - g_2')z^{2N-1} - \ldots\ldots$$

$$\ldots\ldots (p_{2N+1} - g_{2N+1}') = 0 ,$$

each coefficient of which may be chosen at will by appropriate choice of the elements of g'. For a deadbeat error system,

$$g_i' = p_i , \quad i = 1,2,\ldots\ldots, 2N+1$$

Then

$$g = Q^{-1} g' .$$

APPENDIX - II

A second-order recursive lowpass digital filter was used in this study [11]. The algorithm can be described by

$$Y(k) = A.Y(k-1) + B.Y(k-2) + C.X(k) + D.X(k-1) + E.X(k-2)$$

In this equation $X(k)$ is the kth input (unfiltered) signal sample. $Y(k)$ is the kth output (filtered) sample, A, B, C, D, E are constants. These constants are determined from an equivalent 2nd order Butterworth low pass filter of cutt-off frequency 120/100 Hz by the bilinear transformation method. The term recursive means that the output sample $Y(k)$ is a function of previous output samples $Y(k-1)$, $Y(k-2)$ as well as a function of several input samples, $X(k)$, $X(k-1)$, $X(k-2)$.

From a computational point of view, this algorithm requires less calculations than the non-recursive low pass filter.

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2.

Degree	Specialisation	Institution	University	Year
B.Sc.(Hons)	Hons in Physics	Ravensh College, Cuttack	Utkal	1963
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a) Summer Institute in Physics on Feynman Lecturers, Workshop Practice, Laboratory work on Nuclear Physics and Instrumentation , From 24.5.71 to 2.7.71

b) Winter School on Modern Trends in Digital Signal Processing , From 16.12.82 to 29.12.82

c) Summer School on Digital Techniques to Electronic Data Processing Applications , From 25.4.83 to 7.5.83

d) Summer School on Modern Trends in Computer Application to Energy Systems , From 29.4.85 to 12.5.85.