1 SU1

- 6.2
- 6.7
- 6.8
- 6.9
- 6.18
- 6.24
- 6.27
- 6.36
- 6.40
- 6.53
- 6.57
- 6.58
- 6.59
- 6.60
- 6.70
- 6.72
- 6.75
- 6.79
- 6.84

6.2 Determine by inspection whether or not the digital filter structures in Figure P6.2 have delay-free loops. Identify these loops if they exist. Develop equivalent structures without delay-free loops.

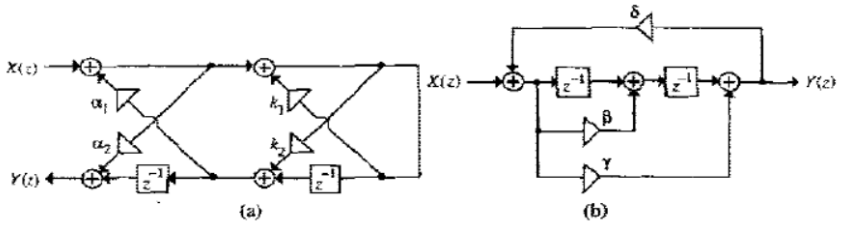

Figure P6.2

6.7 By using the block diagram analysis approach, determine the transfer function $H(z) = Y(z)/X(z)$ of the digital filter structure of Figure P6.6.

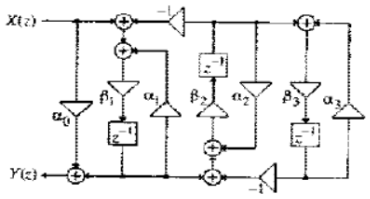

Figure P6.6

6.8 By using the block diagram analysis approach, determine the transfer function $H(z) = Y(z)/X(z)$ of the digital filter structure of Figure P6.7.

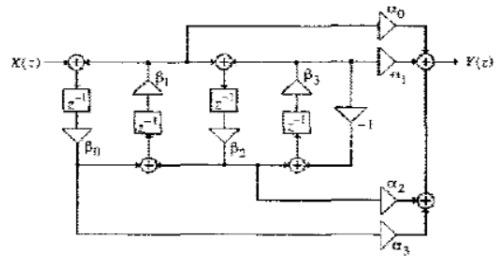

Figure P6.7

6.9 Determine the transfer function of the digital filter structure of Figure P6.8 [Kin72].

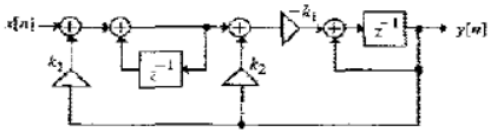

Figure P6.8

6.18 Show that a Type 1 linear-phase FIR transfer function $H(z)$ of length $2M+1$ can be expressed as

$$H(z) = z^{-M}\left[h[M] + \sum_{n=1}^{M} h[M-n]\left(z^{n} + z^{-n}\right)\right]. \tag{6.130}$$

By using the relation

$$z^{\ell} + z^{-\ell} = 2T_{\ell}\left(\frac{z+z^{-1}}{2}\right),$$

where $T_{\ell}(x)$ is the ℓth-order Chebyshev polynomial[10] in x, express $H(z)$ in the form

$$H(z) = z^{-M}\sum_{n=0}^{M} a[n]\left(\frac{z+z^{-1}}{2}\right)^{n}. \tag{6.131}$$

Determine the relation between $a[n]$ and $h[n]$. Develop a realization of $H(z)$ based on Eq. (6.131) in the form of Figure P6.9, where $F_1(z^{-1})$ and $F_2(z^{-1})$ are causal structures. Determine the form of $F_1(z^{-1})$ and $F_2(z^{-1})$. The structure of Figure P6.9 is called the *Taylor structure* for linear-phase FIR filters [Sch72].

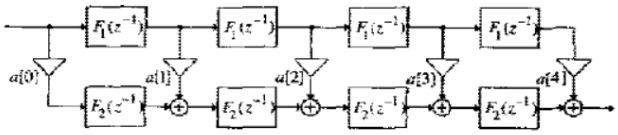

Figure P6.9 The Taylor structure shown for $M = 4$.

2 SU2

- 7.5
- 7.23
- 7.34
- 7.47
- 7.80
- 7.6
- 7.26
- 7.39
- 7.49
- 7.12
- 7.27
- 7.40
- 7.57
- 7.83
- 7.20
- 7.30
- 7.41
- 7.60
- 7.22
- 7.33
- 7.42
- 7.62
- 7.92

3 SU3

- 8.1
- 8.6
- 8.14
- 8.18
- 8.25
- 8.5
- 8.13
- 8.17
- 8.24
- 8.26

- 8.28
- 8.31
- 8.37
- 8.50
- 8.52
- 8.60

4 SU4

- 9.1
- 9.2
- 9.4
- 9.9
- 9.11
- 9.20
- 9.27
- 9.29
- 9.33

5 SU5

- 10.1
- 10.2
- 10.3
- 10.5
- 10.8
- 10.17