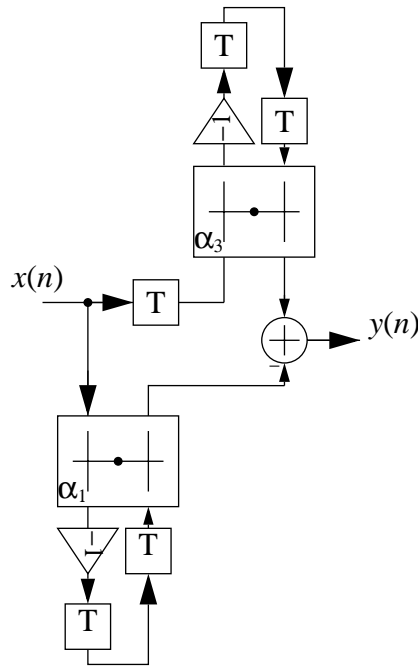
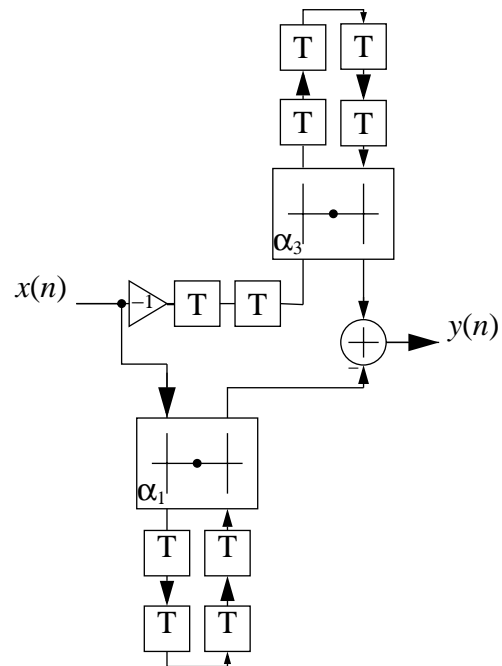


4.20 Lowpass birciprocal lattice WDF is transformed to bandpass filter by $z \rightarrow -z^2$.

- The wave-flow graph for lowpass filter. The filter order N must be odd. For example, a lowpass filter with order $N = 5$ is shown below.
- The bandpass filter can be obtained by replace each delay elements by two delay elements and a multiplier (with coefficient of -1) according to the frequency transformation above.

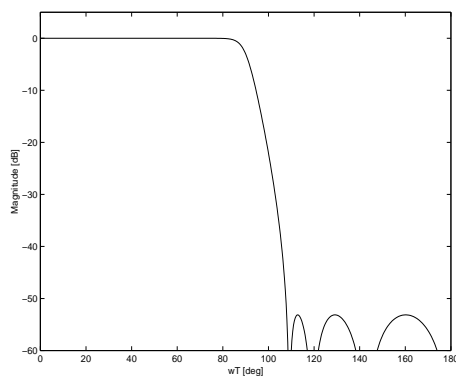


Lowpass Filter ($N = 5$)

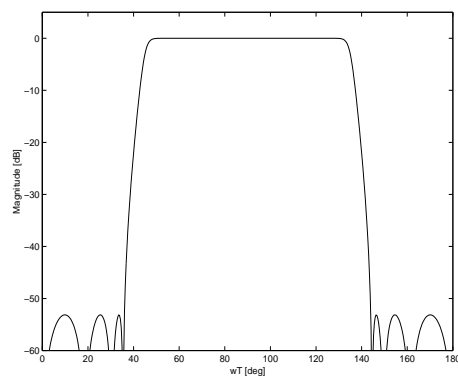


Bandpass Filter ($N = 10$)

- The number of adaptor does not increase, i.e., $\frac{N-2}{4}$.
 - Each adaptor has three additions and one multiplication. The multiplications with -1 outside the adaptors can be computed within the adaptors by changing the signs of the adaptor coefficients. Hence no extra sign inversion is required. The total number of additions is therefore $\frac{N-2}{4} \times 3 + 1$ and the total number of multiplications is $\frac{N-2}{4}$.
- e)



Lowpass filter



Bandpass filter