

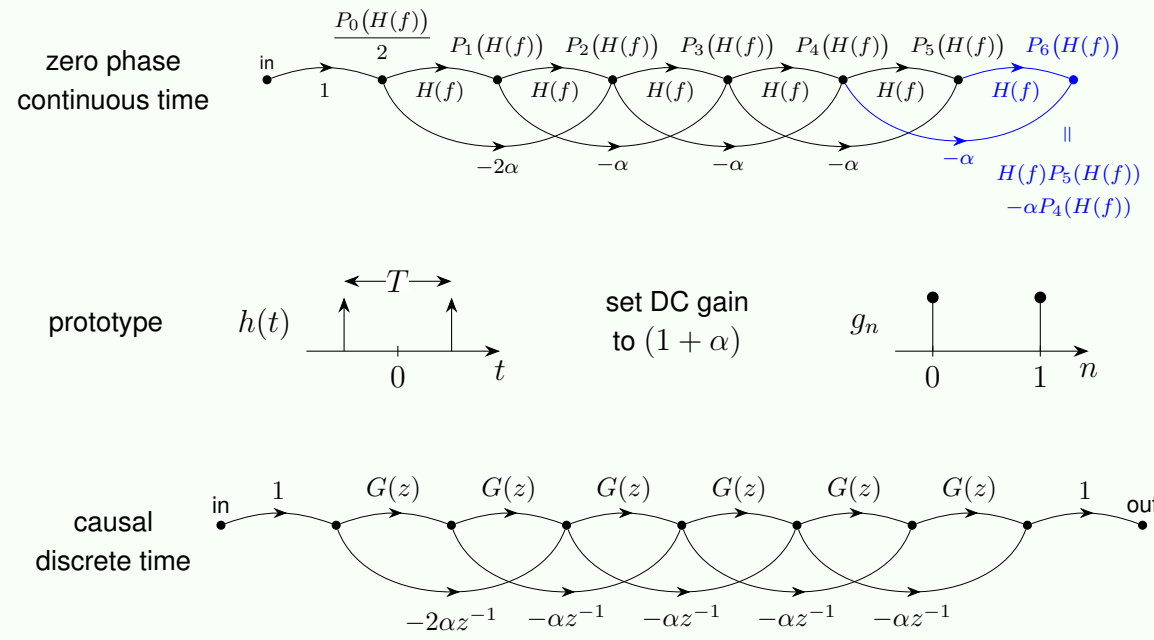
Equiripple-Stopband Multiplierless FIR Filters by Chebyshev Sharpening of Two-Sample Averaging

Jeffrey O. Coleman

Naval Research Laboratory (retired)
Washington DC

<http://alum.mit.edu/www/jeffc>

Sharpen Real $H(f)$ with $P_n(x)$ to Realize $P_n(H(f))$

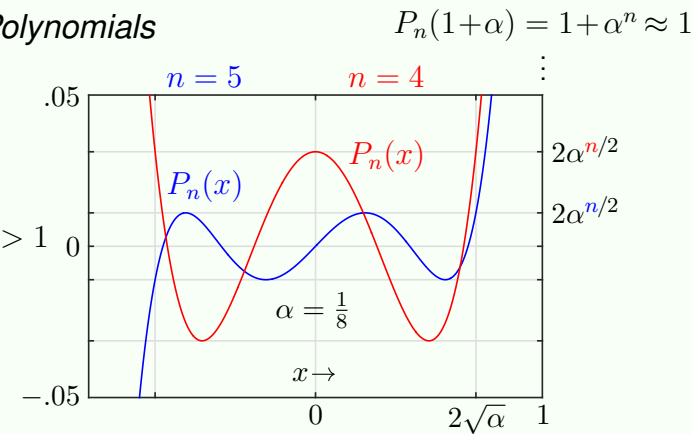


Limited frequency-response choices but

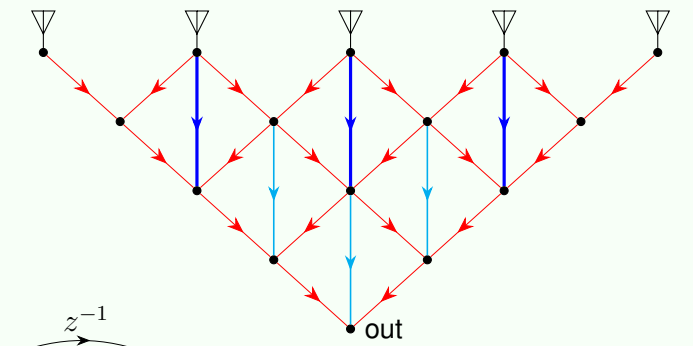
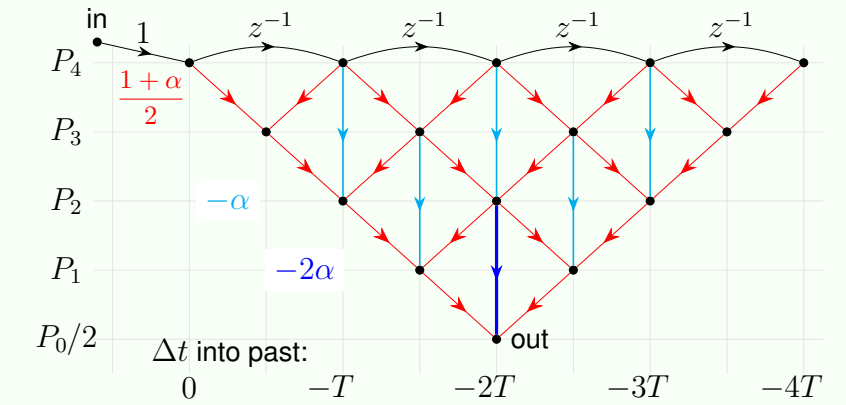
- **exactly equiripple** stopband (any depth)
- **multiplierless**: as few as **two additions times filter order**
- **optional passband flattening** at low computational cost
- **optional tree structure** for small decimation filters or antenna arrays

Scaled Chebyshev Sharpening Polynomials

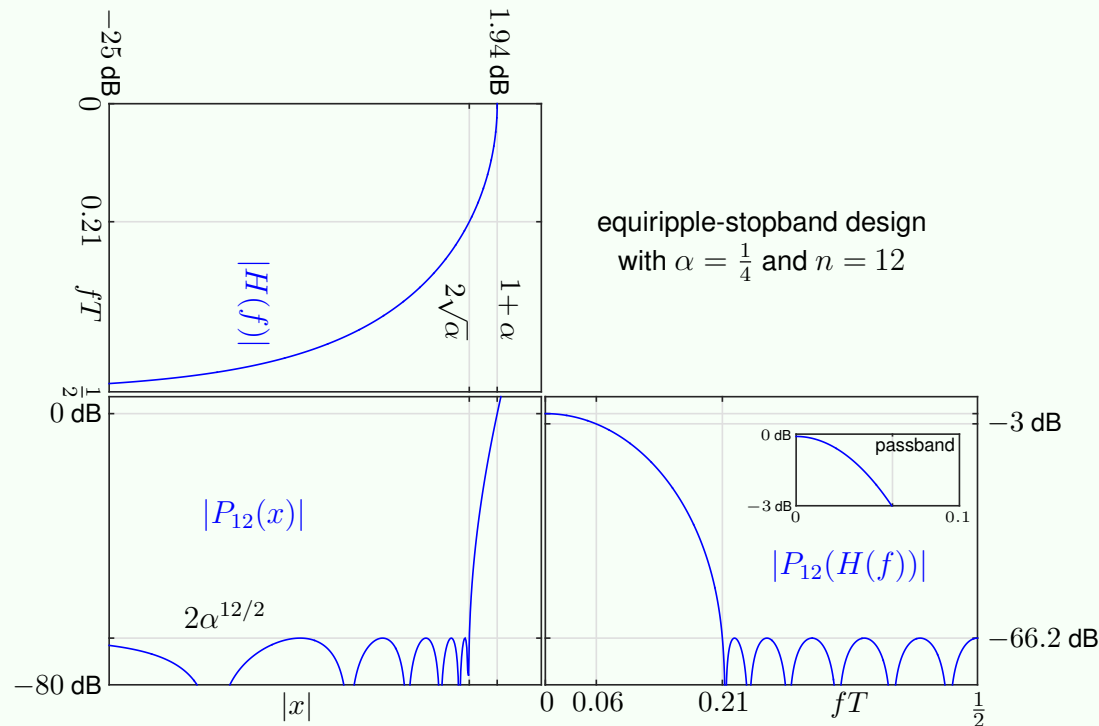
scaled recursion relation
 $P_0(x) = 2, P_1(x) = x,$
 $P_n(x) = xP_{n-1}(x) - \alpha P_{n-2}(x)$ for $n > 1$
 polynomial order n
 $0 < \text{scale parameter } \alpha < 1$



Unroll in Time for Special Applications



An Equiripple Stopband Specified by α and n



Combine Polynomials to Flatten Passband

