Finite impulse response (FIR) filter design

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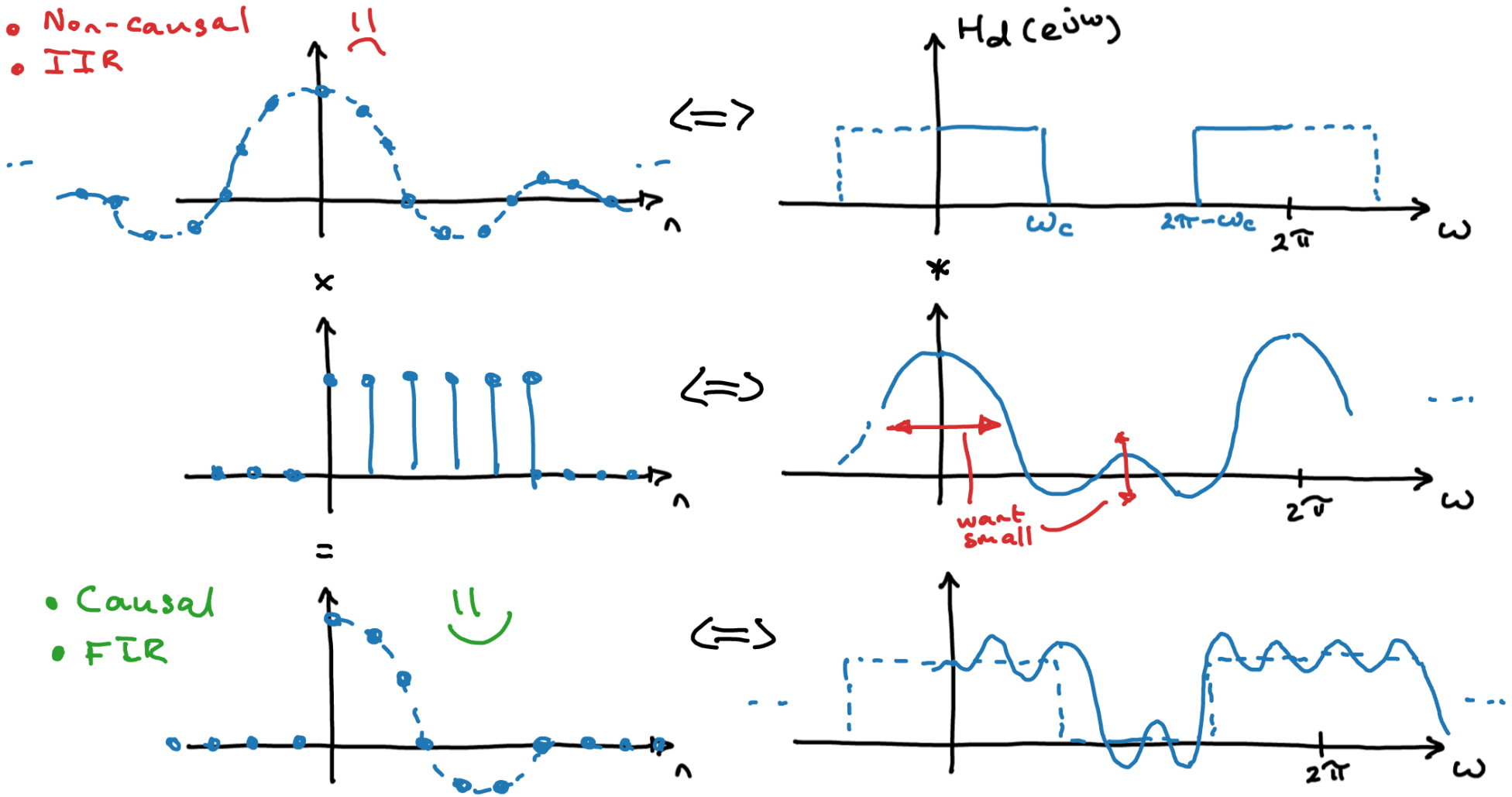
Discrete filter design methods

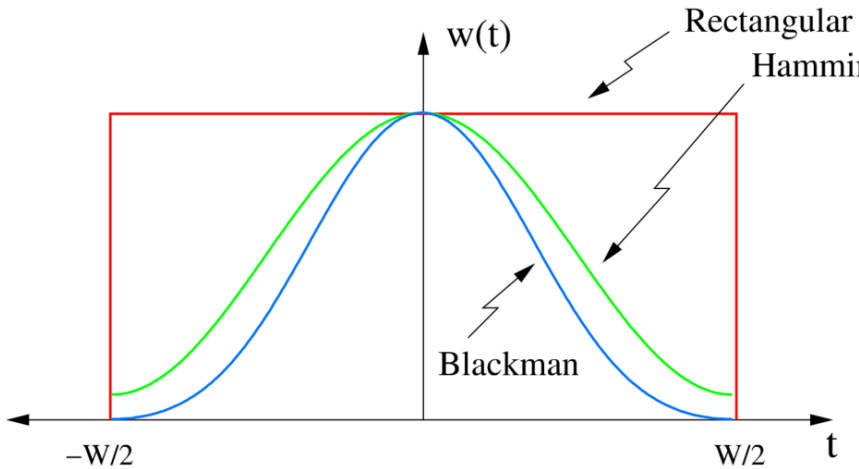
- Place poles and zeros
- Hack the ideal impulse response to make it realisable (FIR)
- Convert continuous filters to discrete filters (IIR)

FIR filter design roadmap

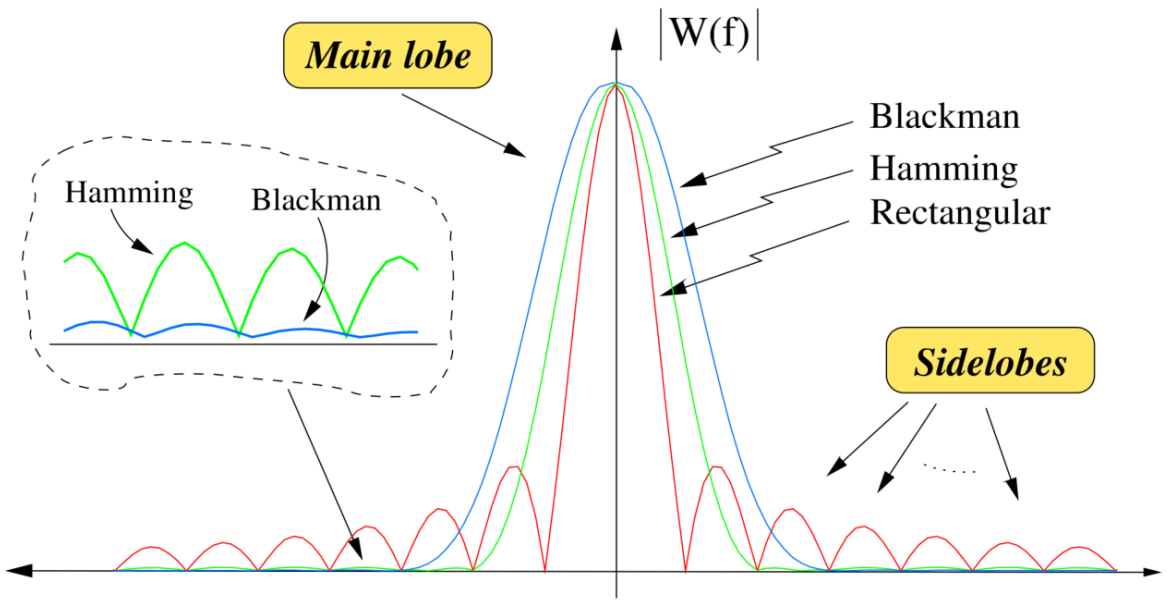
1. Design ideal frequency response, get ideal impulse response
2. Throw away non-causal part and window to get practical FIR filter
3. Understand implications of this hack

FIR filter design



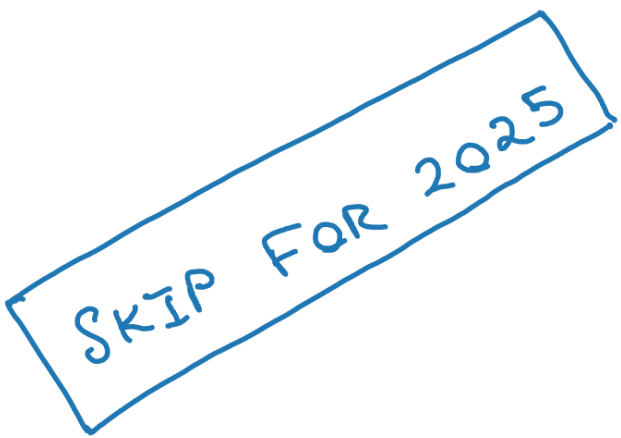

w(t)
Rectangular
Hamming
Blackman
–W/2
W/2
t

- Kaiser


Main lobe
|W(f)|
Blackman
Hamming
Rectangular
Hamming
Blackman
Sidelobes

Linear phase in FIR filters

$$h[n] = \begin{cases} h[M-n] & \text{for } 0 < n \leq M \\ 0 & \text{otherwise} \end{cases}$$

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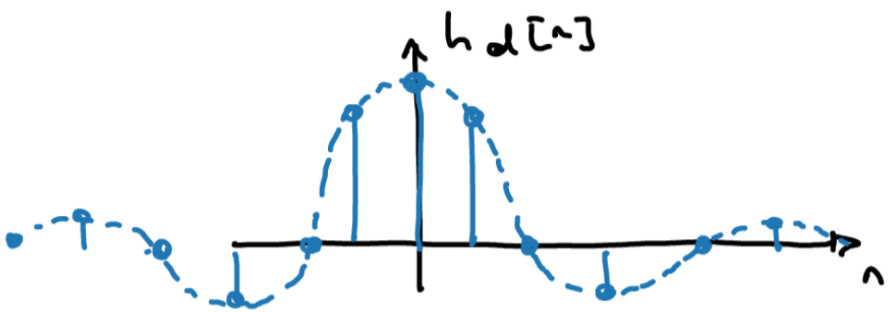
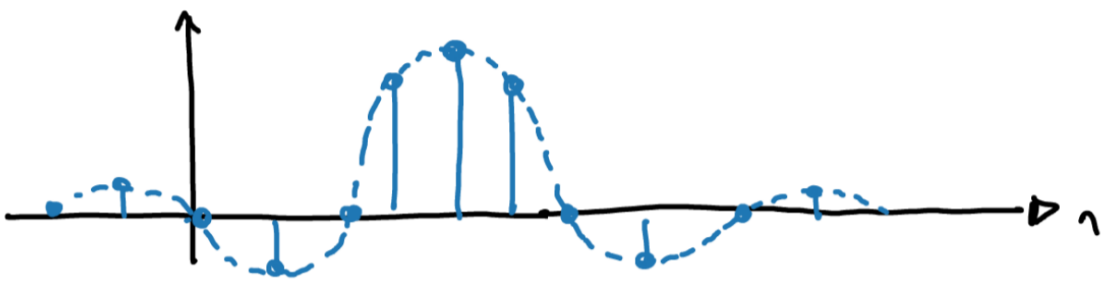
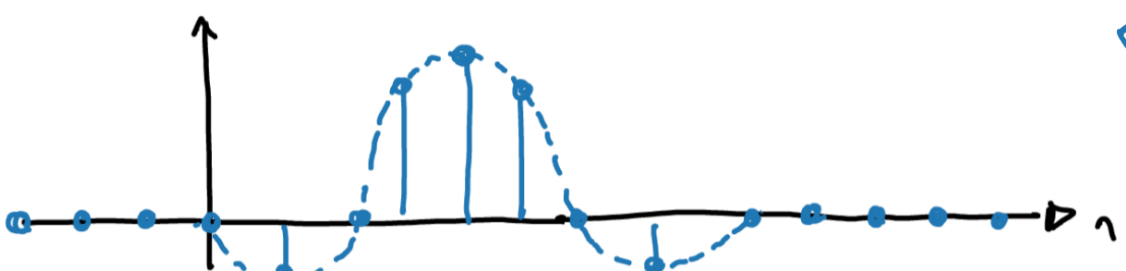
Linear-phase FIR filter design







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