

4/19/21

RASER WINDOWS,

OPTIMUM EQUIRIPLES DESIGN

FREQUENCY-SAMPLING DESIGN

COMPARISON OF FILTER DESIGNS

INTRO TO 18-792

(OSQP 7.6, 7.7.3, 7.7.4, 7.8, 7.9)

WINDOW DESIGN

$$h[n] = \cancel{h_d[n]} \cdot w[n]$$

$$h_d[n - \frac{M}{2}] \quad 0 \leq n \leq M$$

"CLASSICAL" WINDOWS

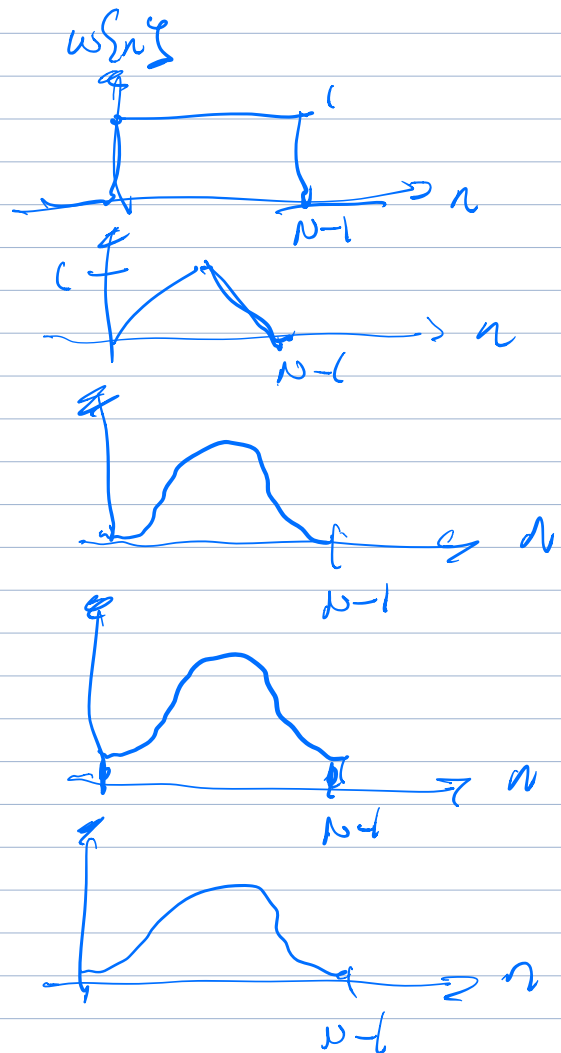
- RECTANGULAR

- BARTLETT

- HANNING (VOITHAND)

- HAMMING (HAMMING)

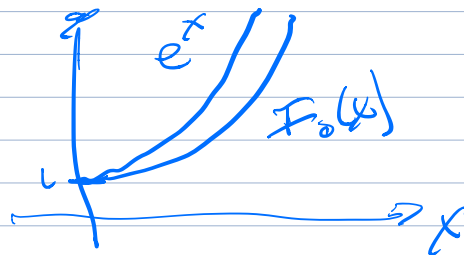
- BLACKMAN



Kaiser windows

$$w[n] = \frac{I_0 \left[\beta \left(1 - \left(\frac{n-2}{2} \right)^2 \right)^{1/2} \right]}{I_0(\beta)} \quad 2 = \frac{M}{2}$$

$I_0[x]$ IMAGINARY BESSEL FN. $\left\{ \begin{array}{l} 0^{\text{th}} \text{ ORDER} \\ \text{KIND} \end{array} \right.$



$I_0(x)$

DESIGN FOR KAISER WINDOWS

$$\text{Let } \Delta\omega = \omega_s - \omega_p = .15\pi$$

$$A = -20 \log_{10} \delta_s = 60$$

$$M = \frac{A-8}{\Delta\omega (2.285)} = \frac{52}{(.15\pi)(2.285)} = 144.88 \rightarrow 145$$

$$\beta = \begin{cases} .1102 (A-8.7), & A \geq 50 \\ .5842 (A-21)^{.4} + .07886 (A-21), & 21 \leq A \leq 50 \\ 0, & A < 21 \end{cases}$$

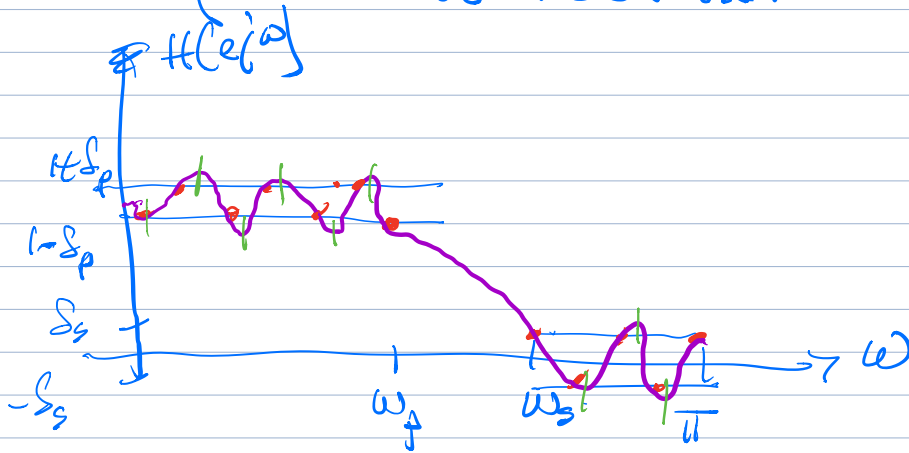
$$.1102 (51.3) = 5.6533$$

CONSIDER $\omega_p = .34$, $\omega_s = .49\pi \Rightarrow \Delta\omega = .15\pi$

DESIGN HD $\omega_c = \frac{\omega_p + \omega_s}{2} = .775\pi$

$$A = 60$$

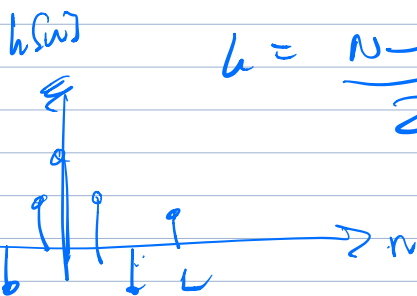
REVIEW OF OPTIMAL EQN RIPPUS FILTERS



NEED AT LEAST $L+2$ ALTERNATIONS

$$L = \frac{N-1}{2}$$

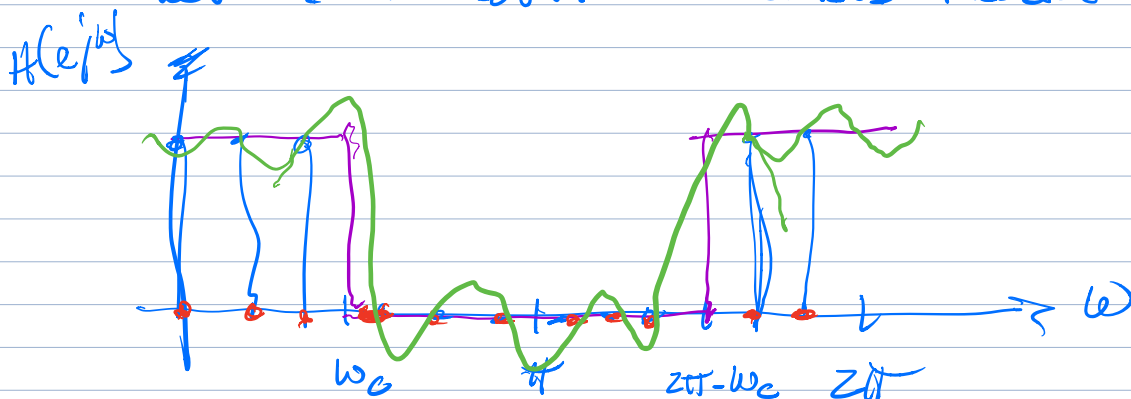
Ex $L=10$



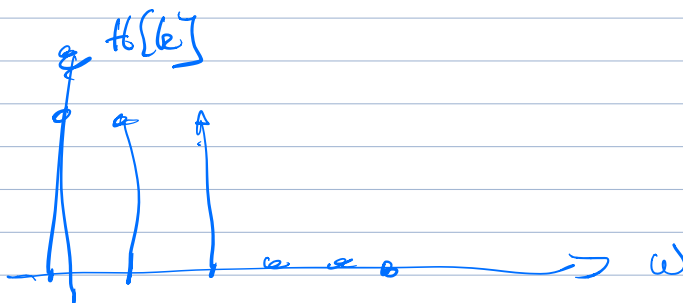
$$L=3$$

FREQUENCY-SAMPLING DESIGN

let DFT COEFFS = DESIRED FREQUENCY VALUES



CHOOSE $N=11$



$$2. \text{ Let } H[k] = H(e^{j\omega}) \Big|_{\omega = \frac{2\pi k}{N}}, \quad 0 \leq \omega < 2\pi$$

$$3. \text{ Let } h[n] = \text{IDFT}\{H[k]\}$$