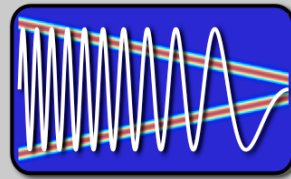


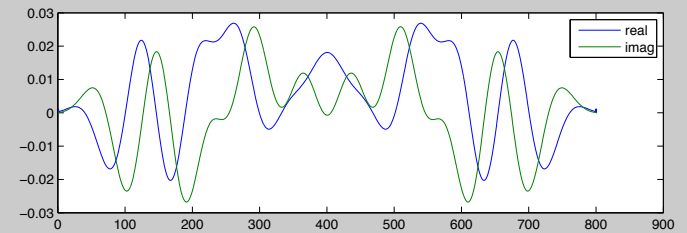
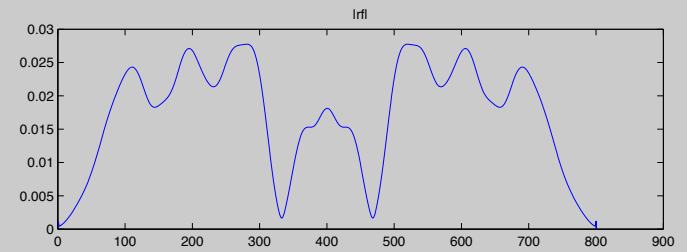
EE123



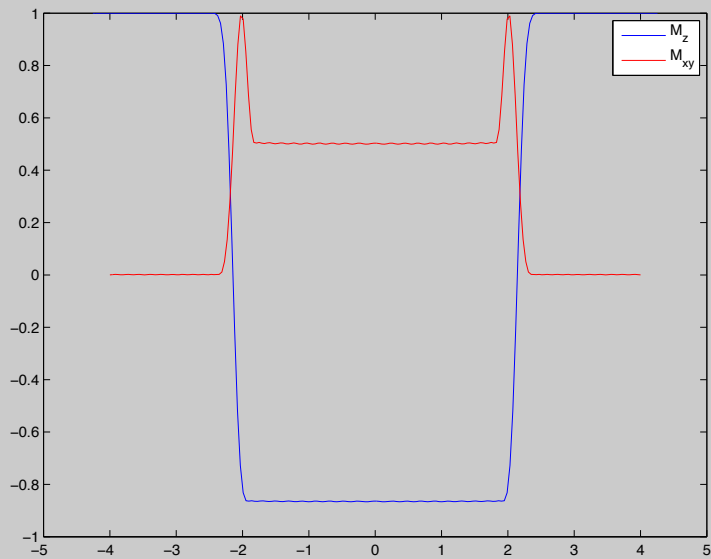
Digital Signal Processing

Lecture 30

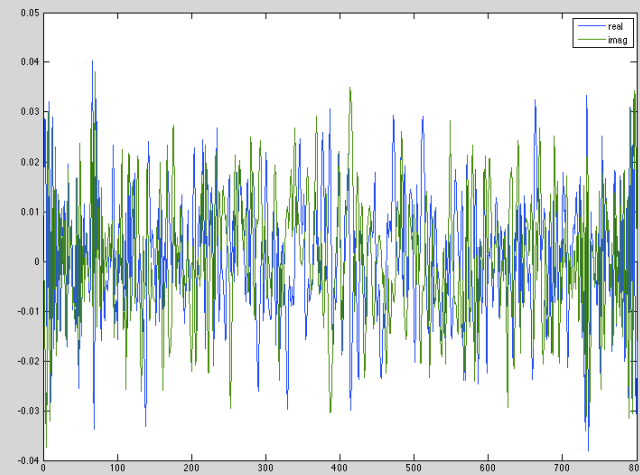
The Eagle Pulse



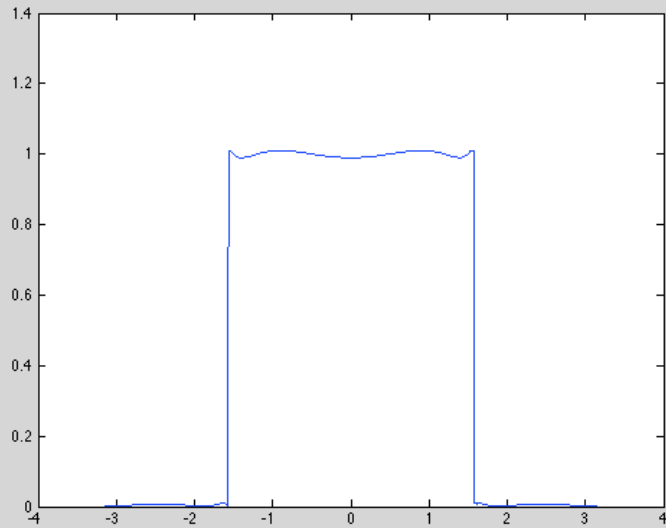
Selectivity



What type of impulse response is this?

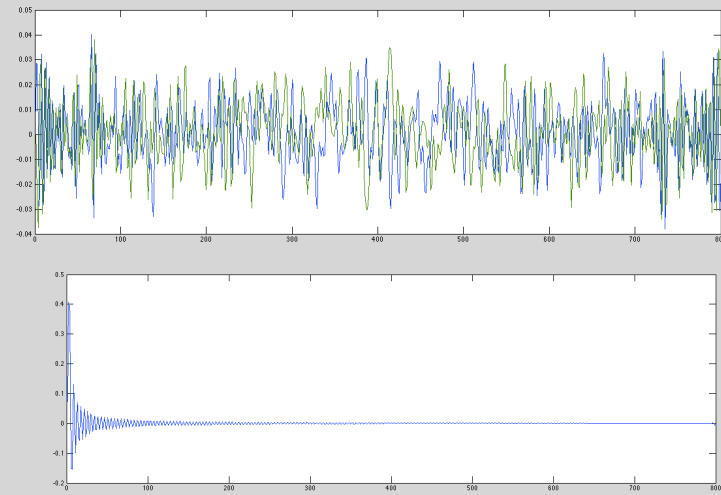


Frequency Response (Low pass!)



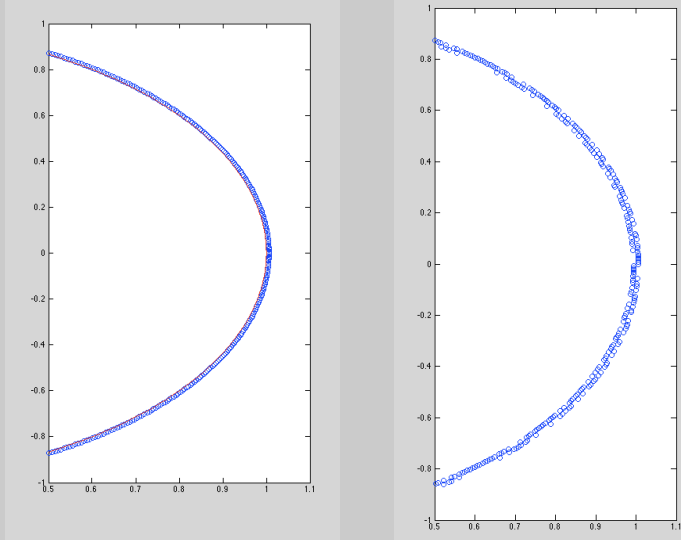
UC Berkeley

Non-linear phase vs. Minimum phase



M. Lustig, EECS UC Berkeley

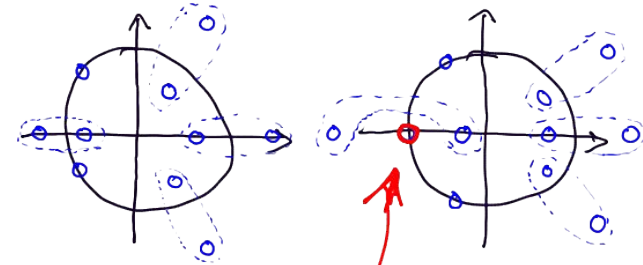
Non-linear phase vs. Minimum phase



EECS UC Berkeley

$$H(z) = z^{-M} H(z^{-1}) \quad \text{Type I, II}$$

(7)



$$H(-1) = 0 \quad \text{Type II (Never high-pass)}$$

→ FOR GUP, IF $a = re^{j\theta}$ is a zero
 $\frac{1}{a^*}$ is also a zero

zeros of GLP system

(8)

Type I, II: $h[n] = h[n-M]$

$$H(z) = \sum_{n=0}^M h[n] z^{-n} =$$

$$= \sum_{n=0}^M h[M-n] z^{-n} = z^{-M} \sum_{n=0}^M h[M-n] z^{M-n}$$

$\underbrace{M-n}_{\equiv k}$

$$= z^{-M} \sum_{k=0}^M h[k] z^k$$

$$\Rightarrow H(z) = z^{-M} H(z^{-1})$$

for type II:

odd

$$H(-1) = (-1)^M H(-1) = -H(-1) \Rightarrow H(-1) = 0$$

similarly, can show for

(8)

type III, IV

$$H(z) = -z^{-M} H(z^{-1})$$

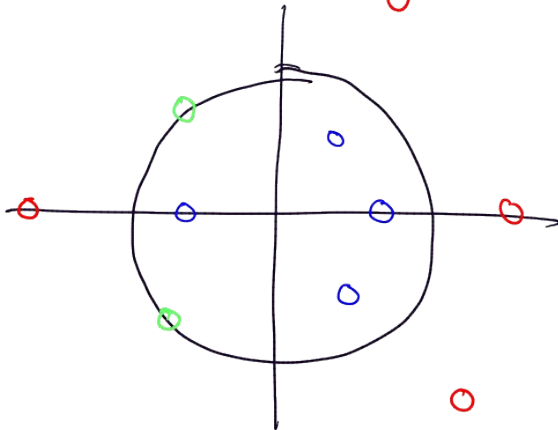
$$H(1) = 0 \rightarrow \text{Never low-pass}$$

for type III

$$H(-1) = 0 \text{ only band pass}$$

Relation of FIR GLP to min-phase systems

(9)



$$H(z) = H_{\min}(z) H_{\max}(z) H_{\text{all}}(z)$$

↑
minimum
phase

↑
maximum
phase