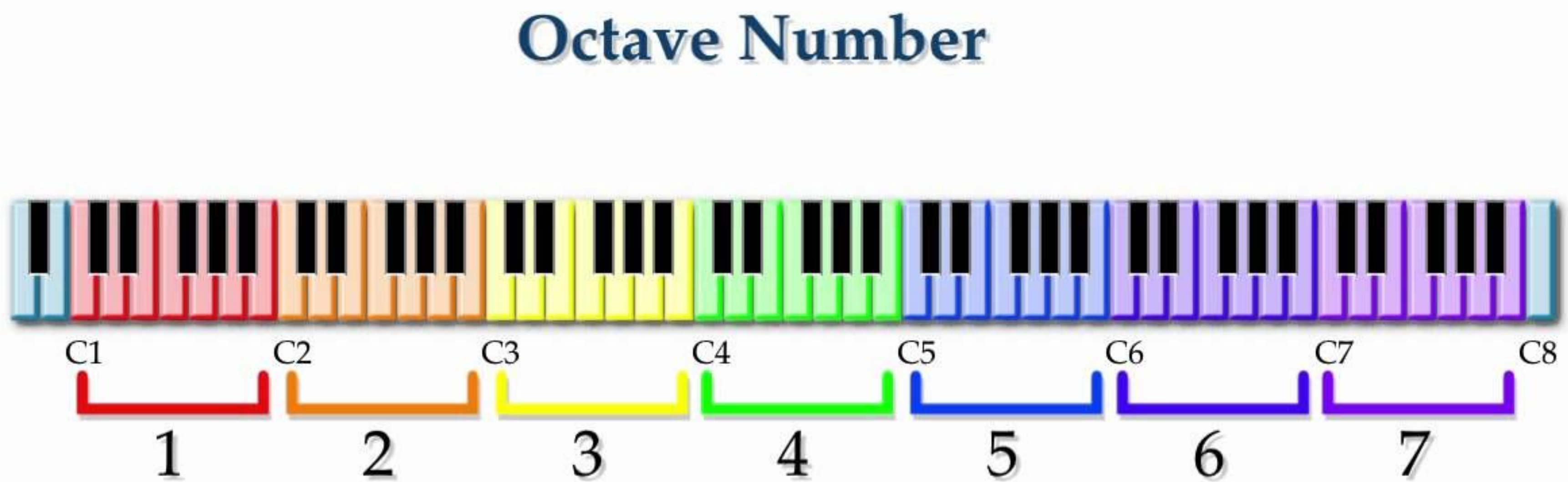


OCTAVE BAND FILTERING

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Digital Signal Processing, University of Utah, Utah



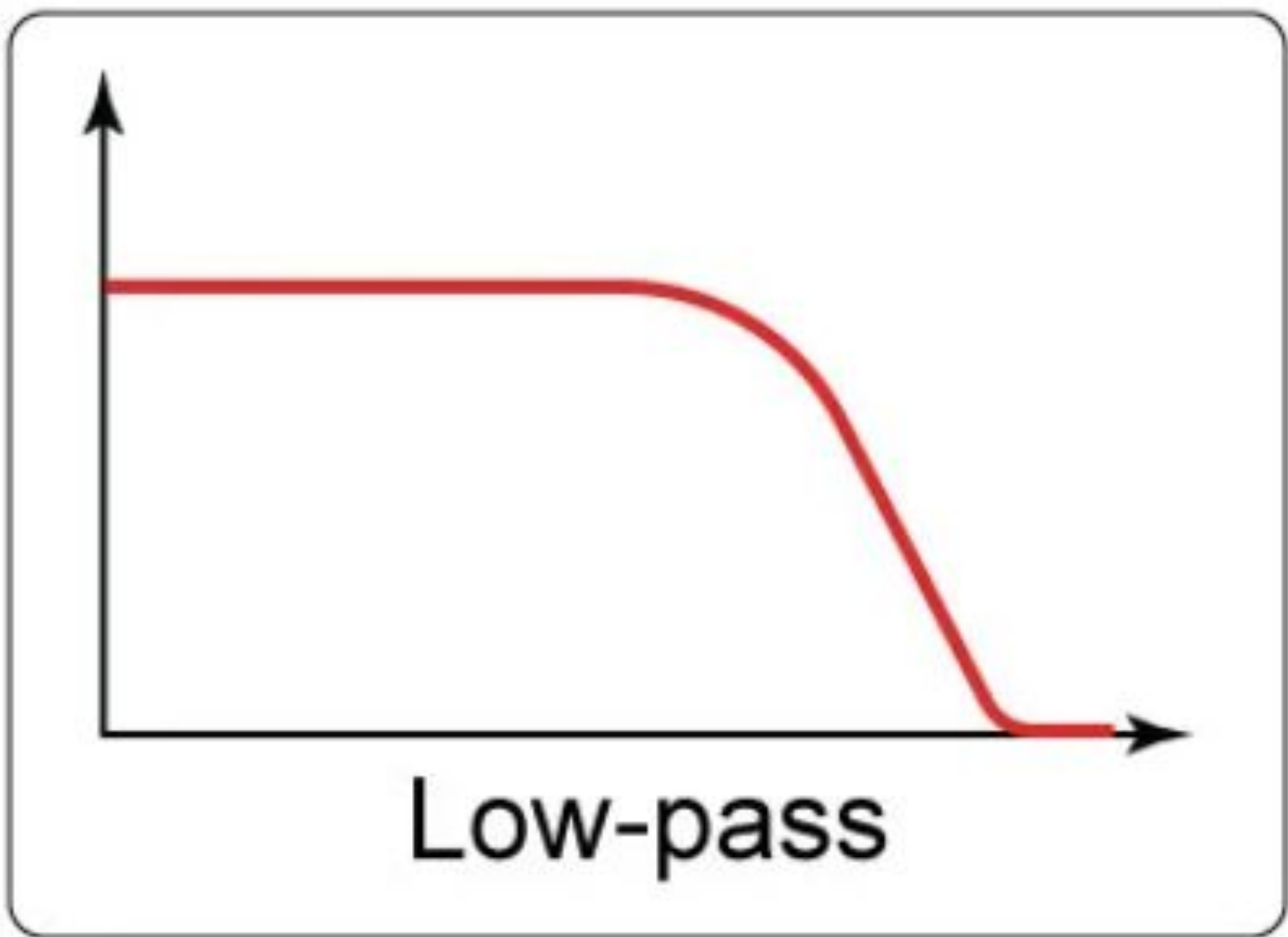
Octave
 $\log_2 \frac{f_1}{f_2}$

Note
 $2^{1/12}$

nth key
 $f(n) = 440 * 2^{\frac{n-49}{12}}$

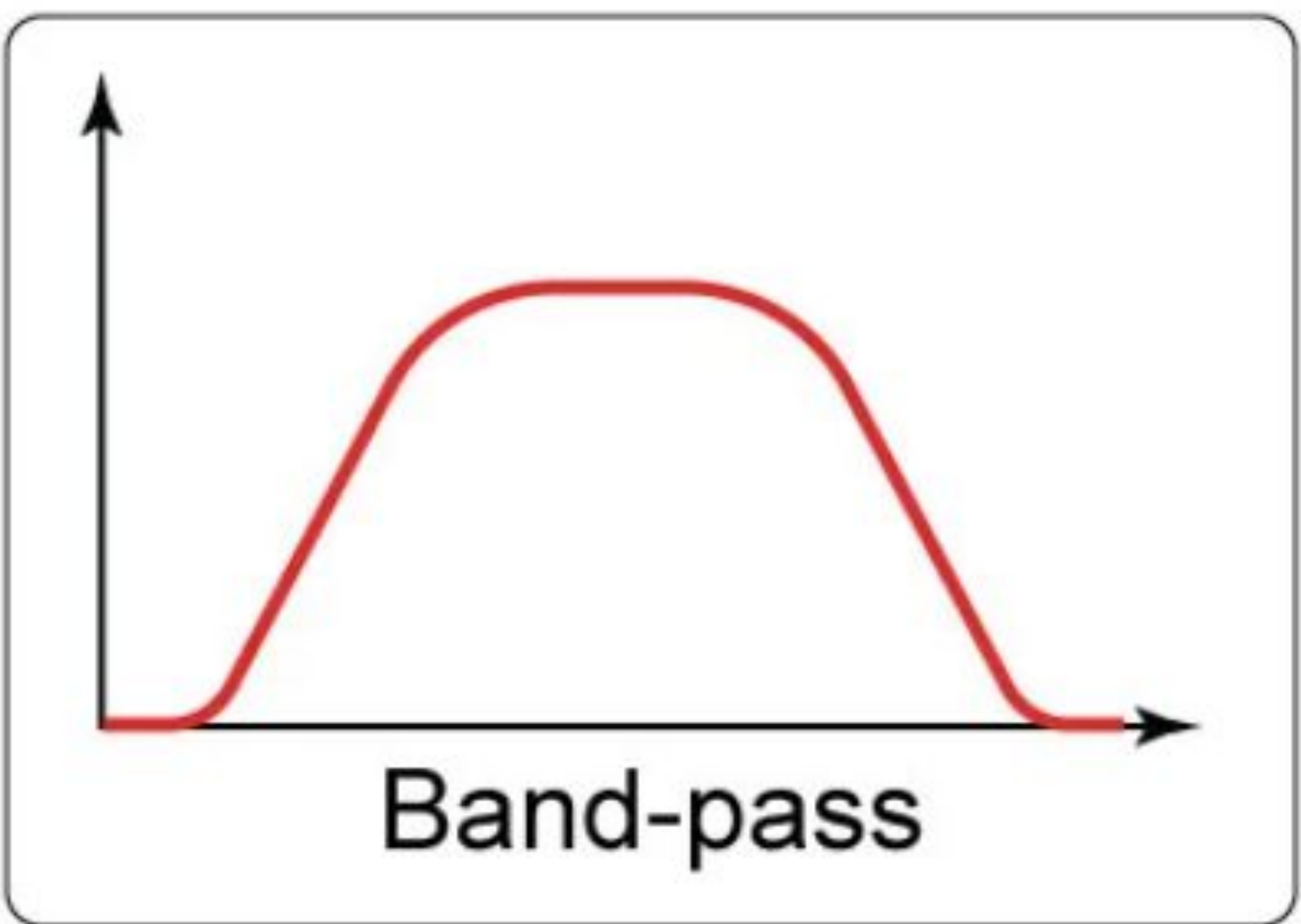
$BW = \frac{C}{L}$

Low-pass filter



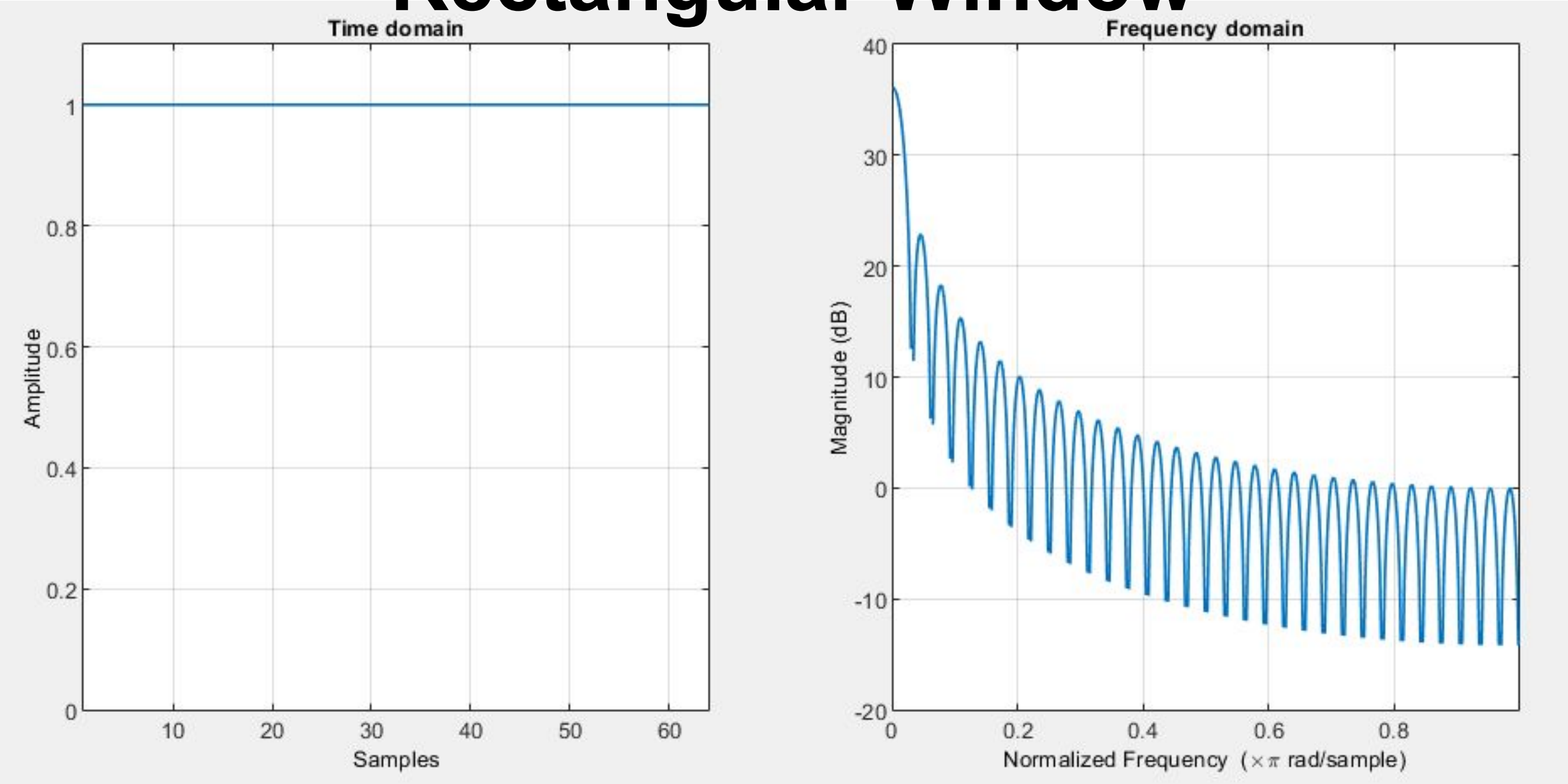
Passes low frequencies
Passes middle frequencies
Attenuates high frequencies

Band-pass filter

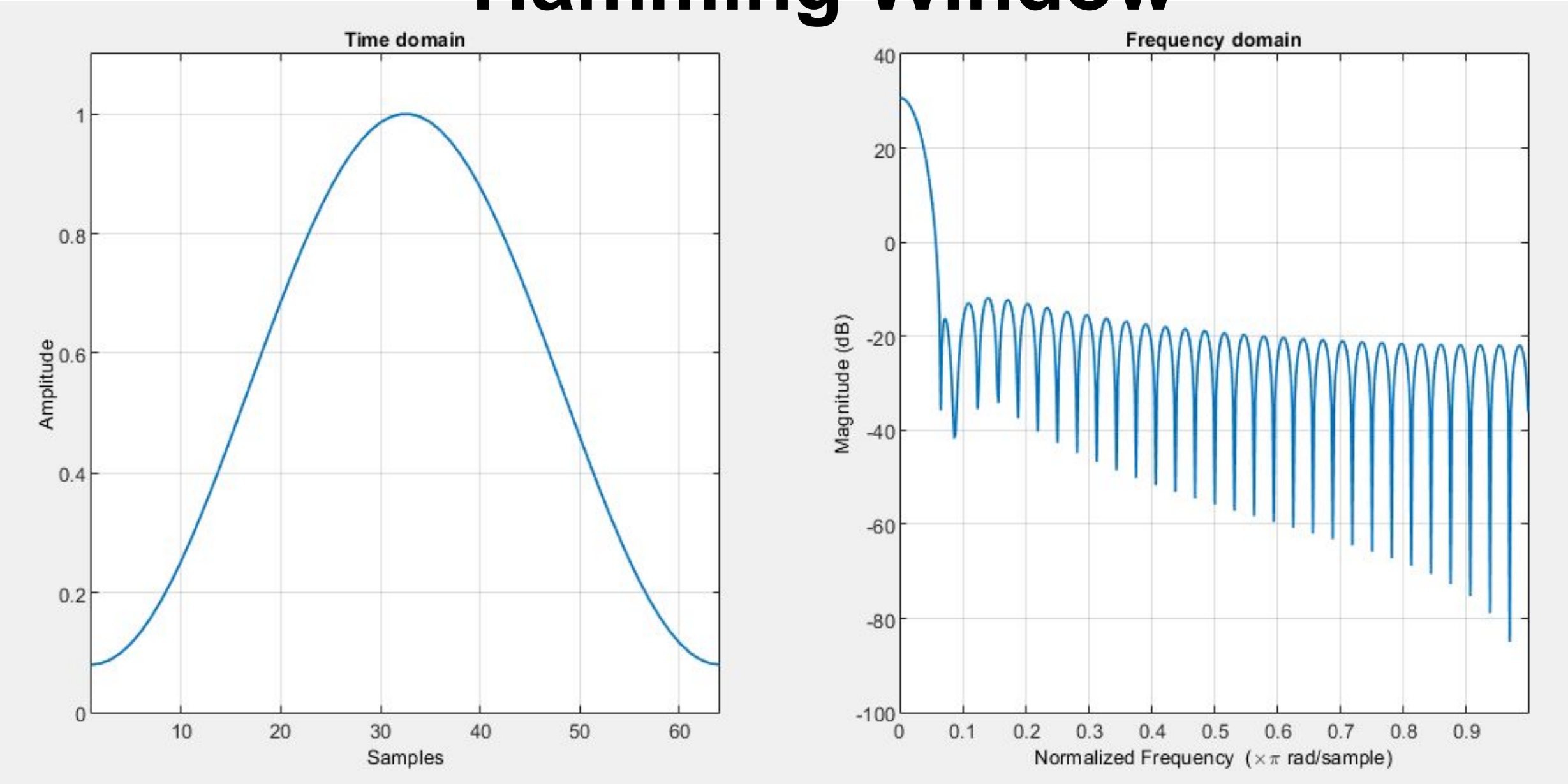


Attenuates low frequencies
Passes middle frequencies
Attenuates high frequencies

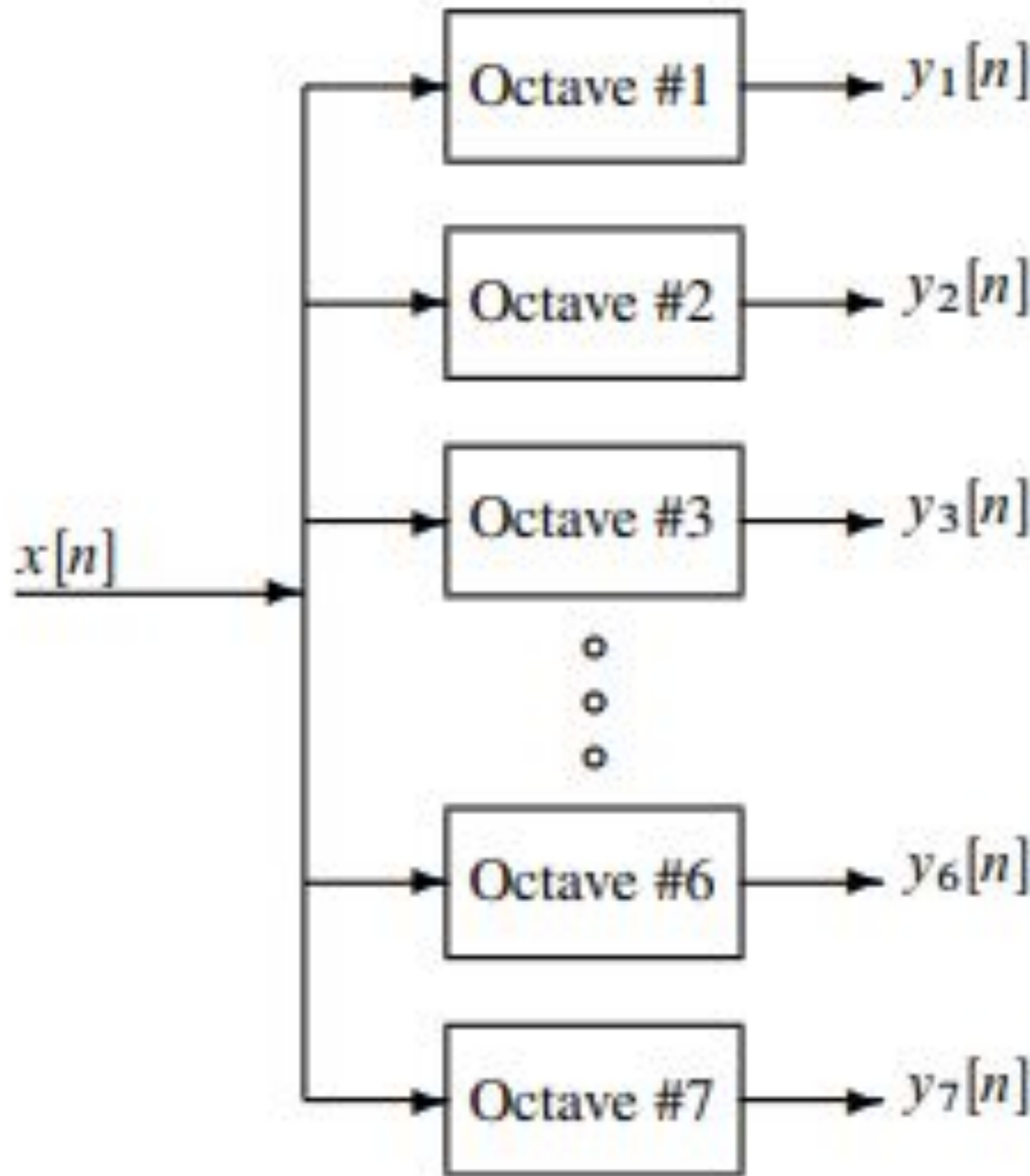
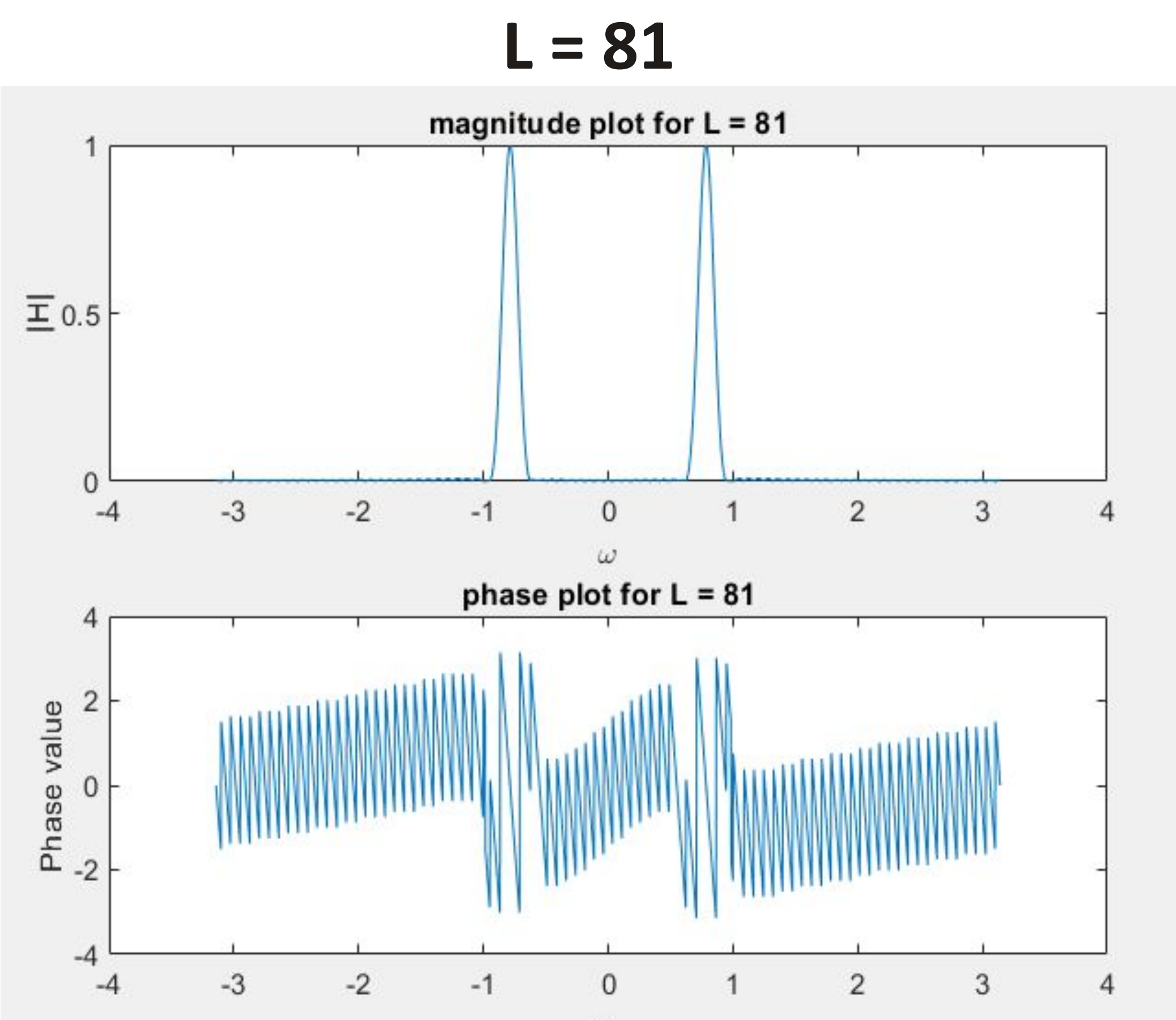
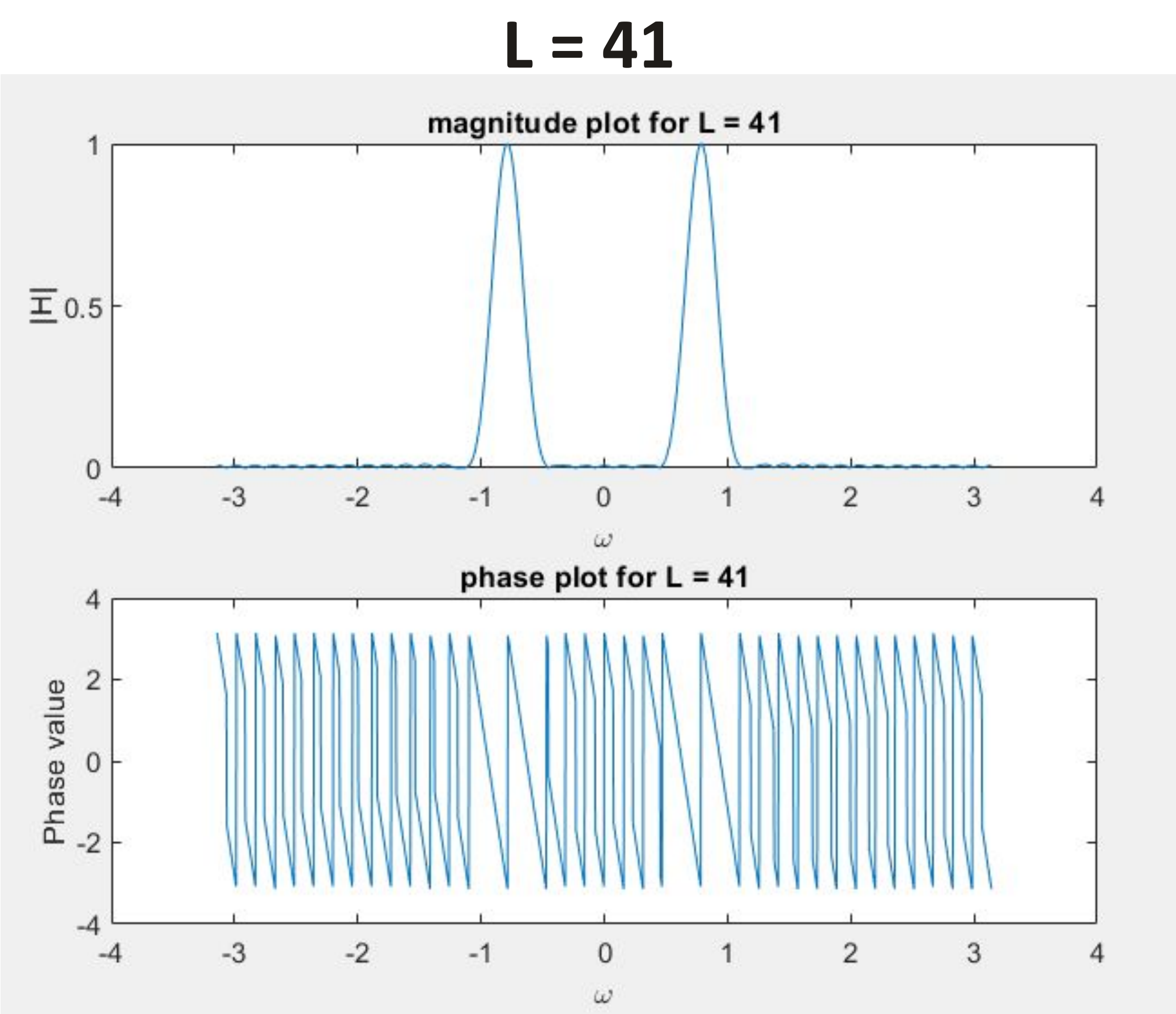
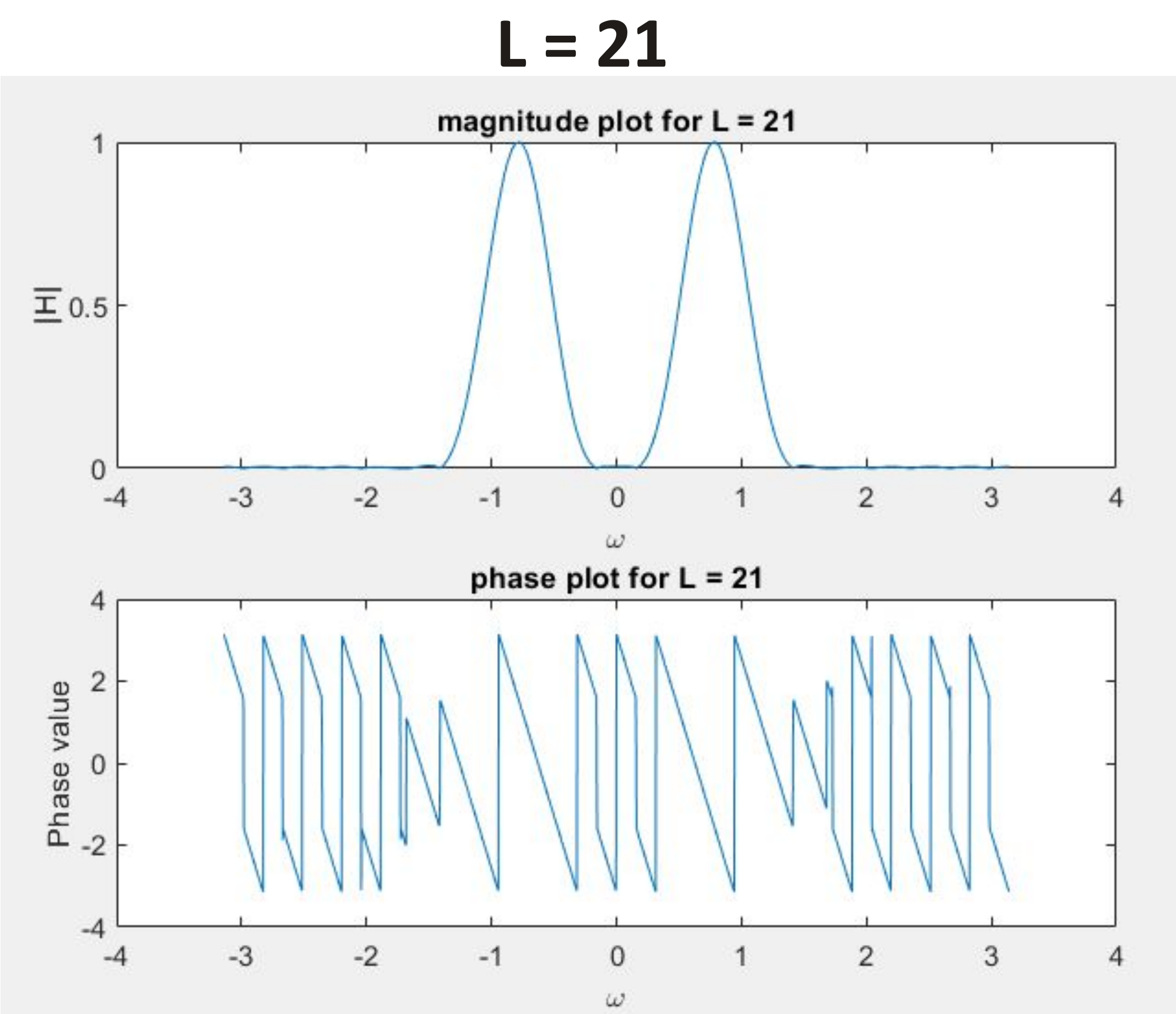
Rectangular Window



Hamming Window



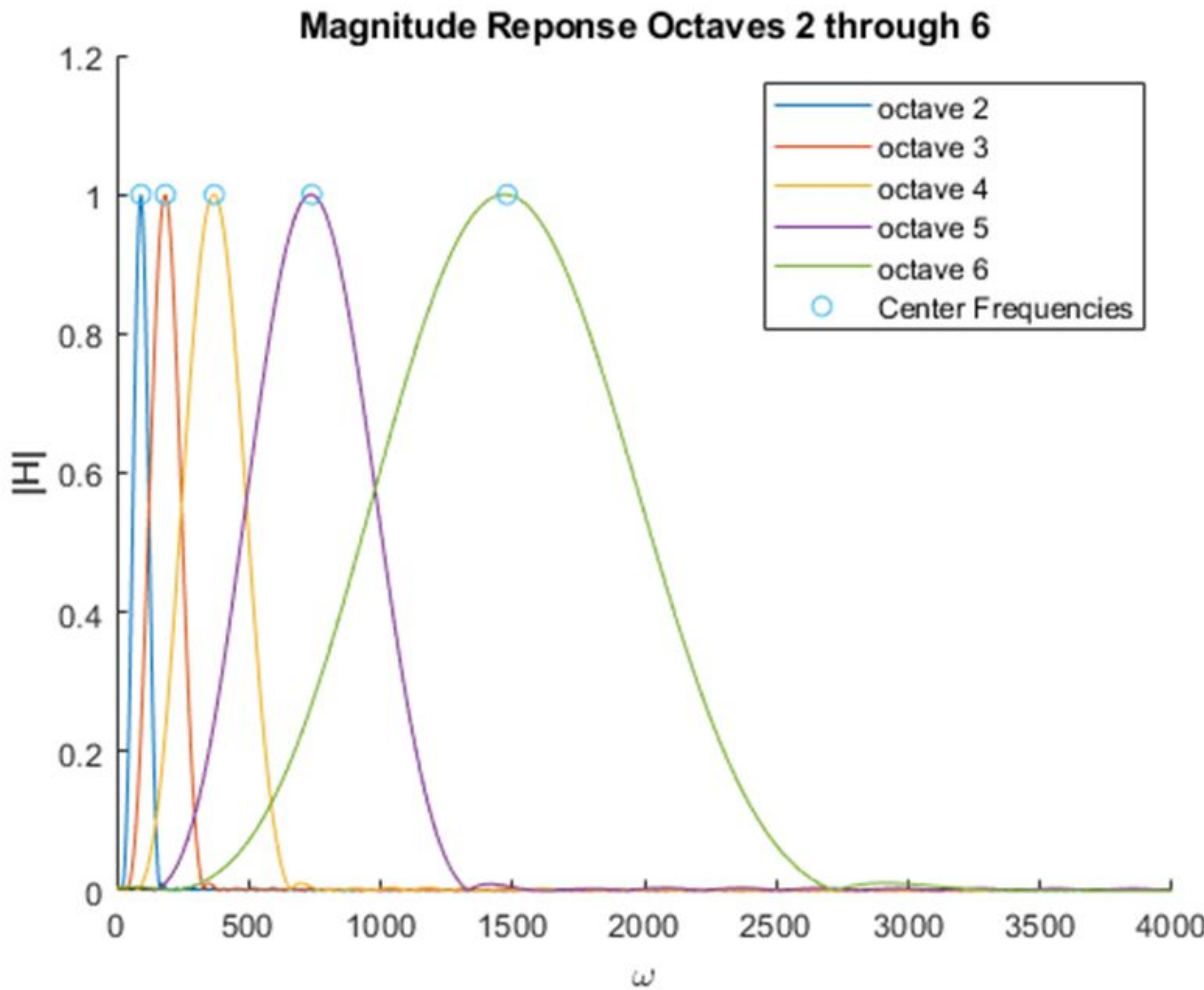
Window	Leakage Factor	Sidlobe Attenuation	Mainlobe width
Rectangular	9.14%	-13.3 dB	0.027
Hamming	0.03%	-42.5 dB	0.039
Blackman	0%	-58.1 dB	0.051



Octave	Lower edge (rad)	High edge (rad)	Center (rad)
2	0.051370	0.102740	0.072648
3	0.102740	0.204480	0.145296
4	0.205480	0.410960	0.290593
5	0.410960	0.821921	0.581186
6	0.821921	1.643842	1.162372

$$h[n] = \beta \left(0.54 - 0.46 \cos\left(\frac{2\pi n}{L-1}\right) \right) \cos\left(\omega_c \left(n - \frac{L-1}{2}\right)\right) \text{ for } n = 0, 1, \dots, L-1$$

- Hamming dependent on L and center frequency ω_c
- Scaled by β such that maximum magnitude $\omega_c=1$



$$x(t) = \begin{cases} \cos(2\pi(220)t) & 0 \leq t < 0.25 \text{ s} \\ \cos(2\pi(880)t) & 0.3 \leq t < 0.55 \text{ s} \\ \cos(2\pi(440)t) + \cos(2\pi(1760)t) & 0.6 \leq t < 0.85 \text{ s} \end{cases}$$

