Digital Signal Processing (EE313): FIR filter design using windowing

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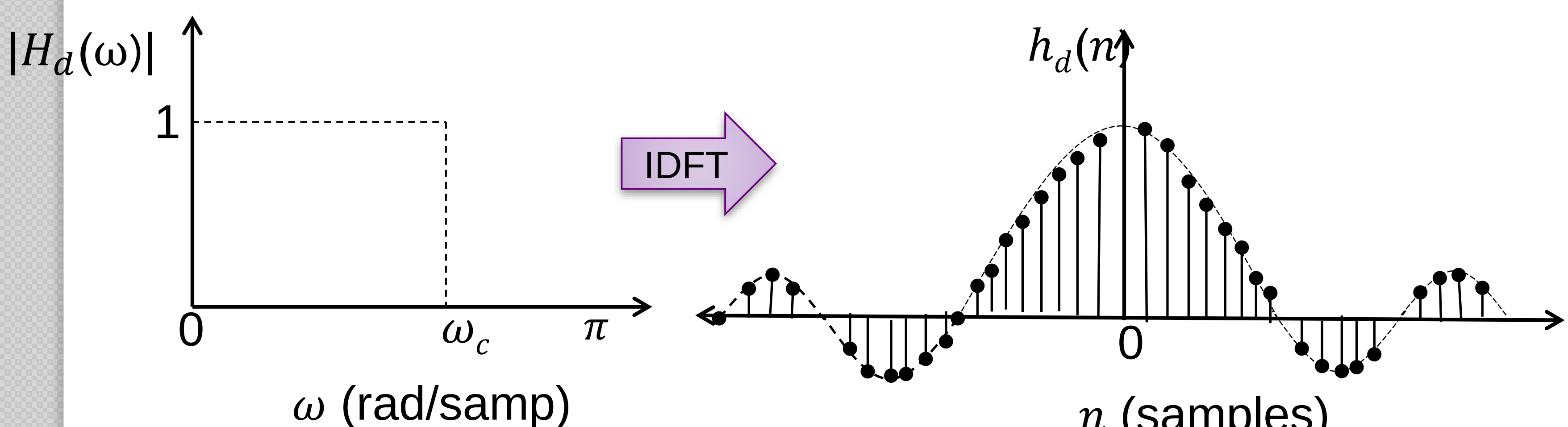
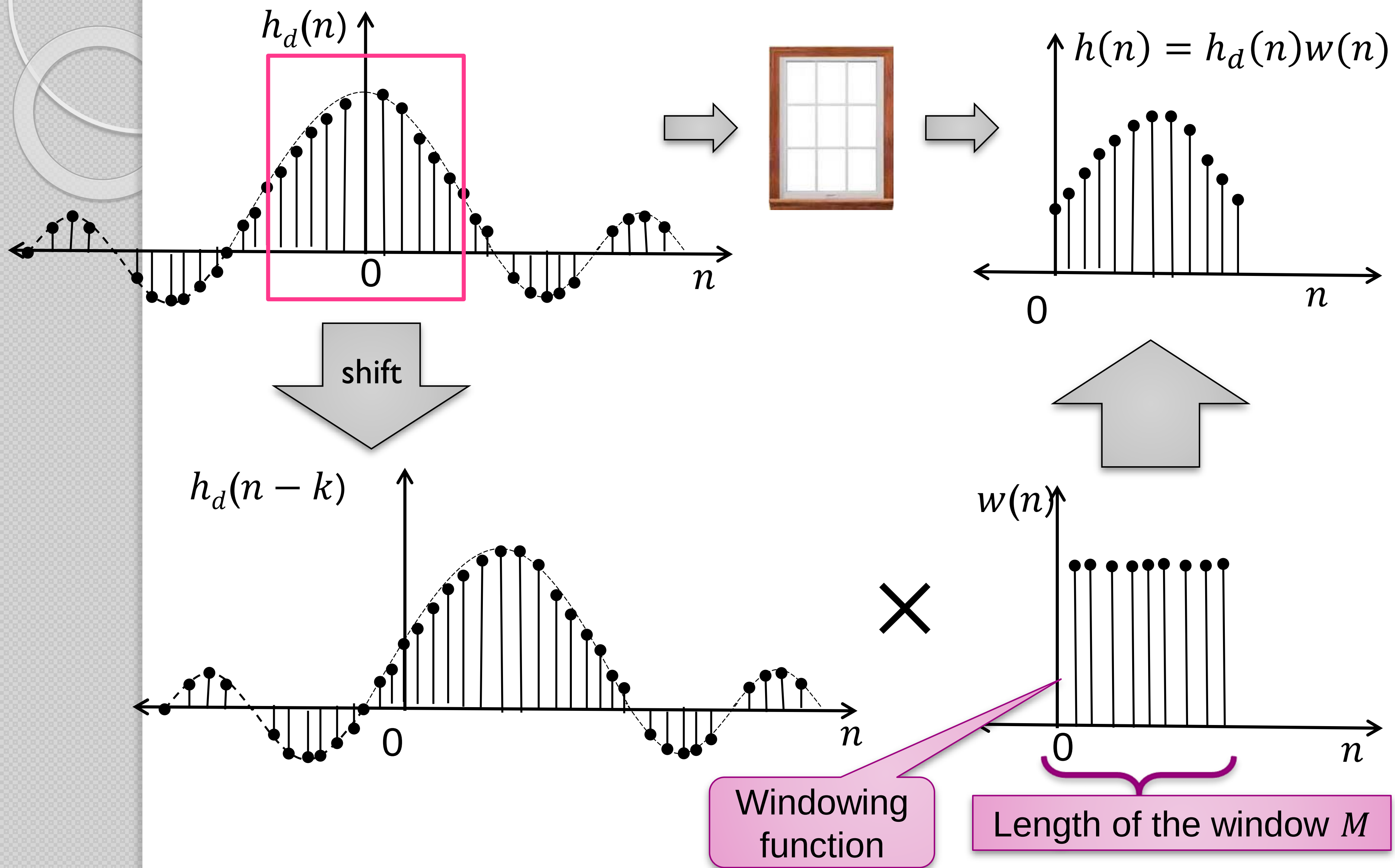
Design using windows:

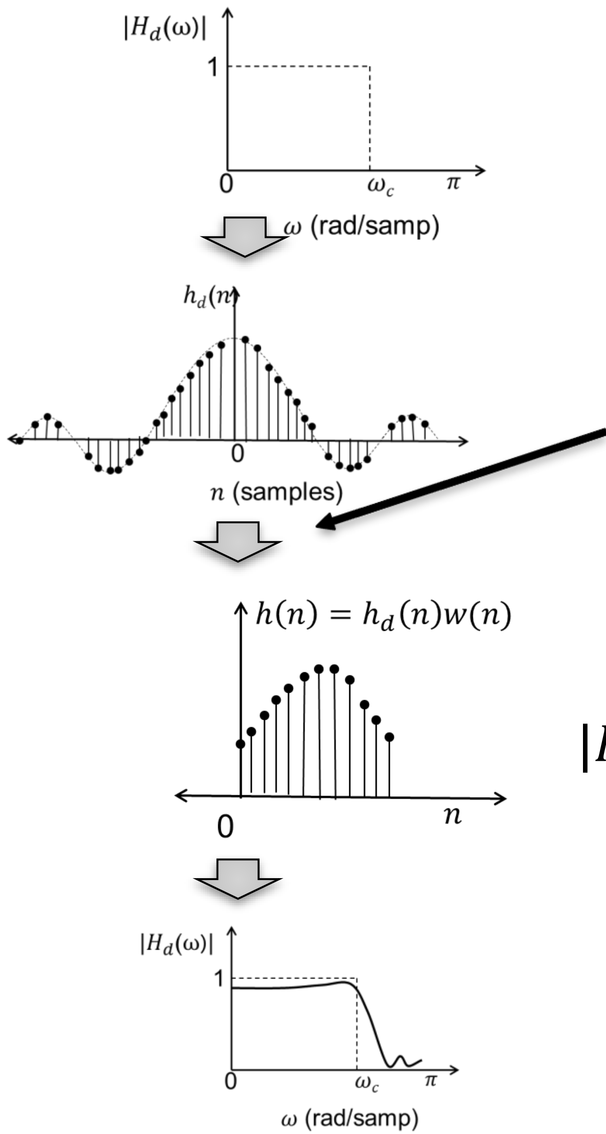
- Starts from a desired frequency response (mostly ideal response)
- Ideal response is:
  - acausal
  - stays for infinite duration



Design using windows:

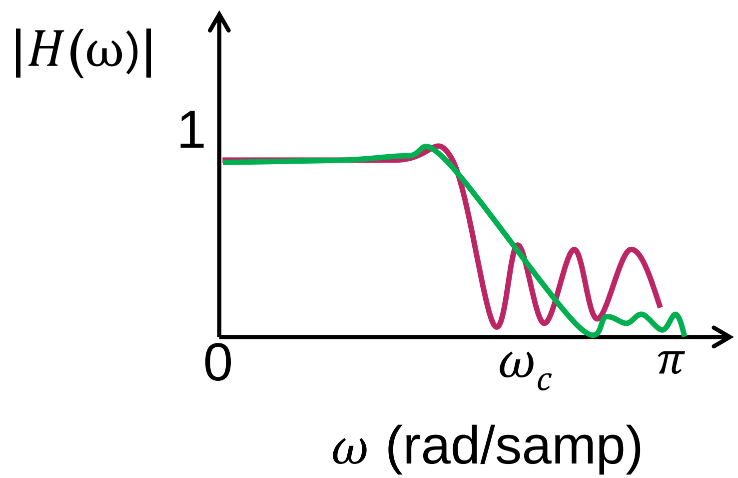


Design using windows:



Time domain Windowing of the ideal impulse response

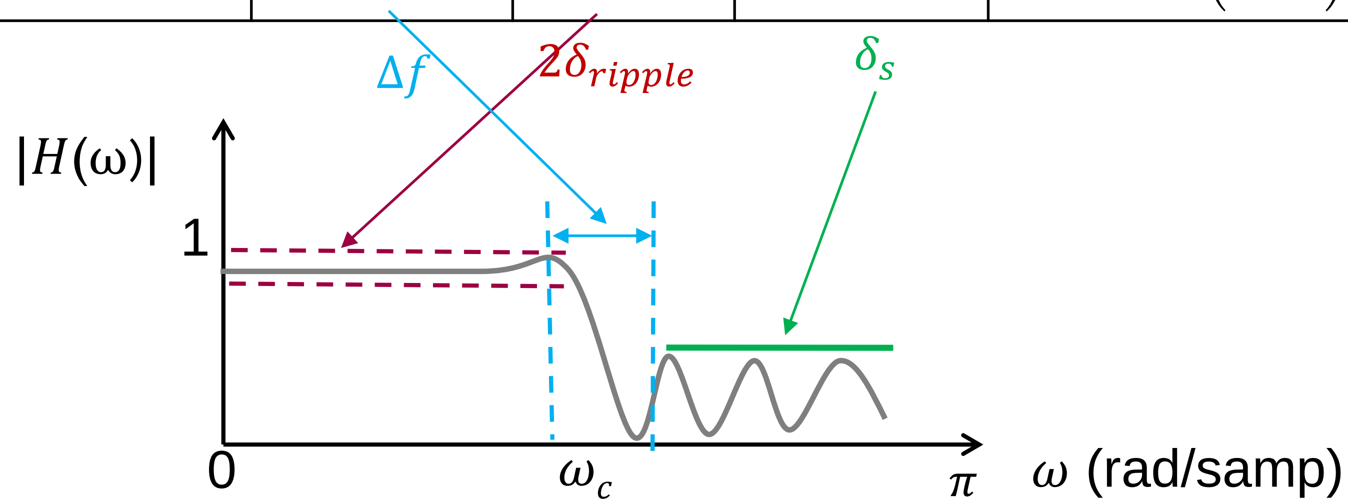
- Rectangular
- Hamming/Hanning



Different window functions:

Window Properties

Window	Transition width (Hz) normalized	Pass band ripple	Stop band attenuation	Time-domain sequence $0 \leq n \leq M-1$
Rectangular	$\frac{.9}{M}$	.07416	21	1
Hanning	$\frac{3.1}{M}$	.0546	44	$.5 - .5\ \cos\left(\frac{2\pi n}{M-1}\right)$
Hamming	$\frac{3.3}{M}$	.0194	53	$.54 - .46\ \cos\left(\frac{2\pi n}{M-1}\right)$
Blackman	$\frac{5.5}{M}$	.0017	75	$.42 - .5\ \cos\left(\frac{2\pi n}{M-1}\right) + .08\ \cos\left(\frac{4\pi n}{M-1}\right)$



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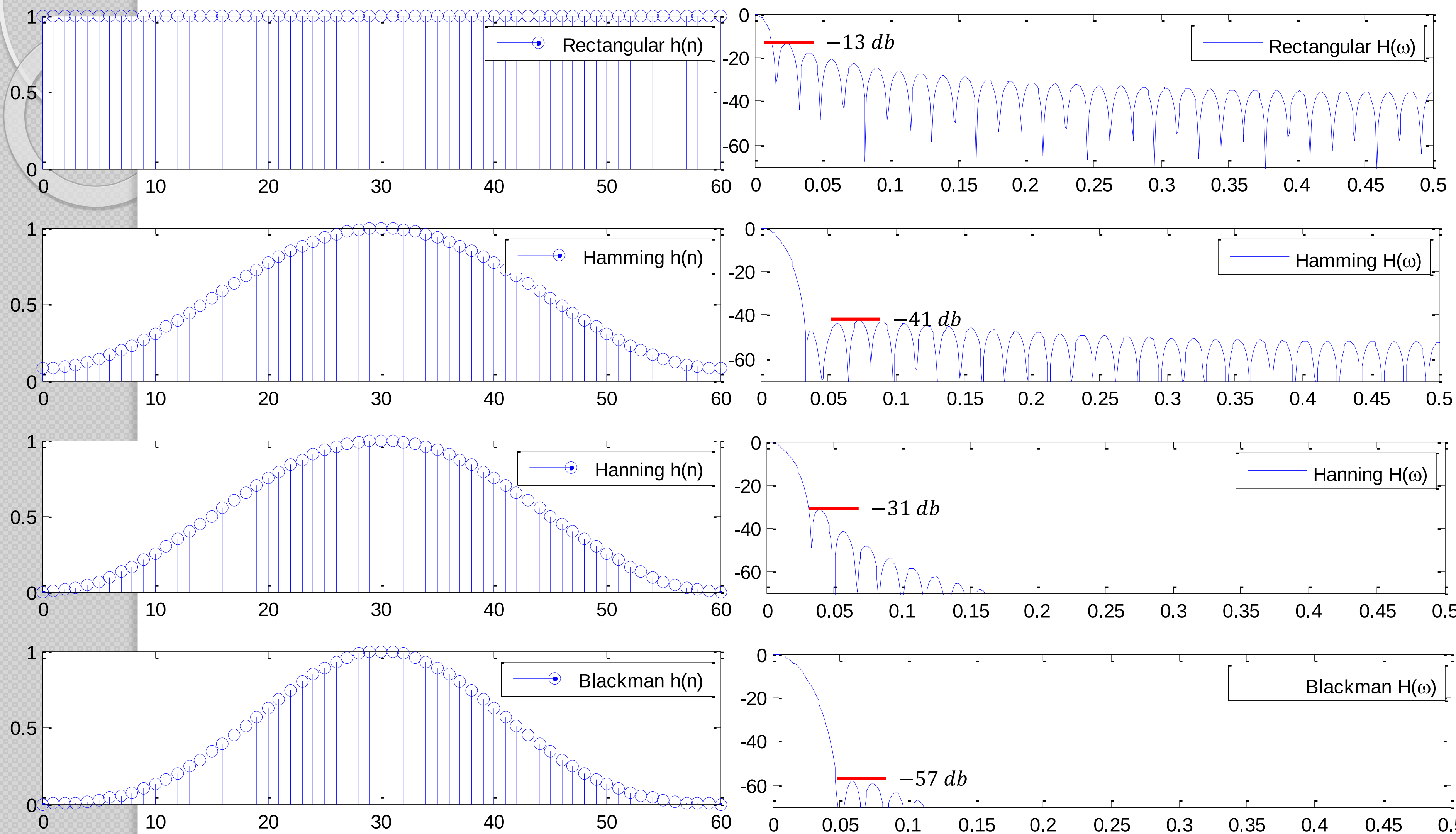

FIR Filter design flow chart: