TSKS21 Signaler, information & bilder

Föreläsning 8

Rester fönstring

Sampling och rekonstruktion

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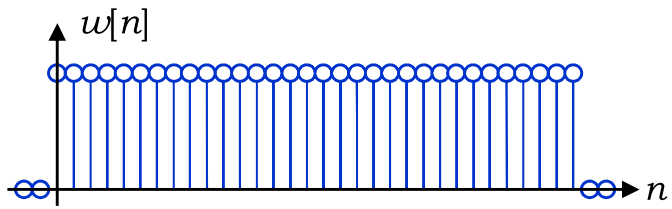
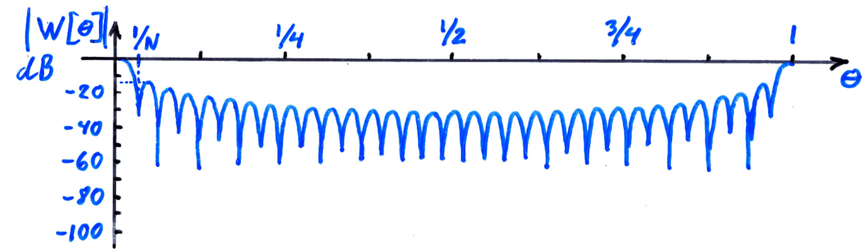
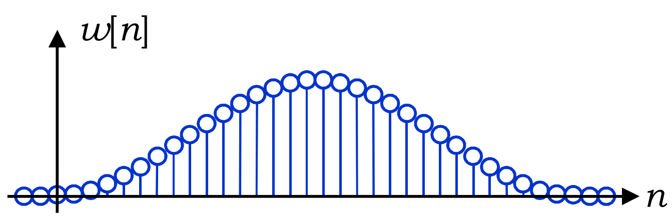
Exampel på fönster, N=32

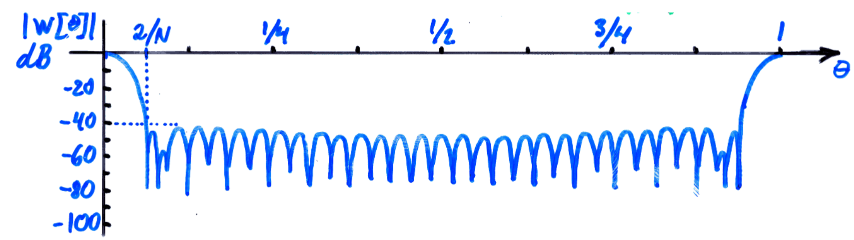
Rektangulärfönster: $w[n] = 1, \quad n \in \{0, 1, \ldots, N-1\}$





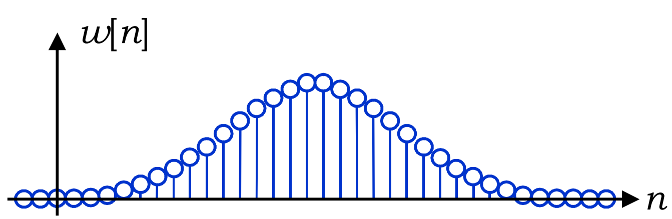
Hammingfönster: $w[n] = 0.54 - 0.46\cos(\frac{2\pi N}{N-1}), \quad n \in \{0, 1, \ldots, N-1\}$

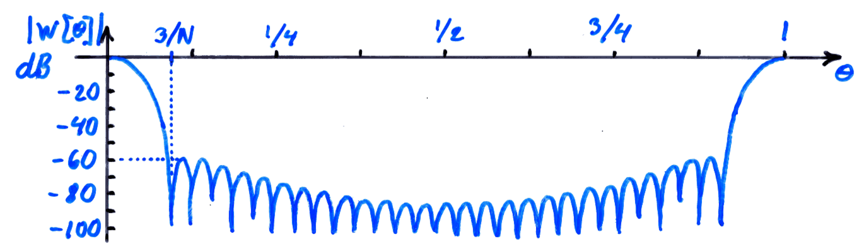




Blackmanfönster: $w[n] = 0.42 - 0.5\cos(\frac{2\pi N}{N-1}) + 0.08\cos(\frac{4\pi N}{N-1}),$

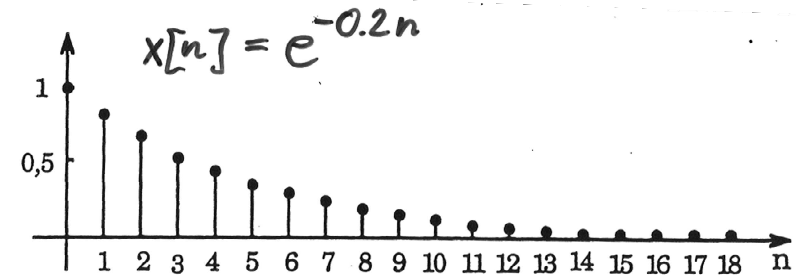
$n \in \{0, 1, \ldots, N-1\}$

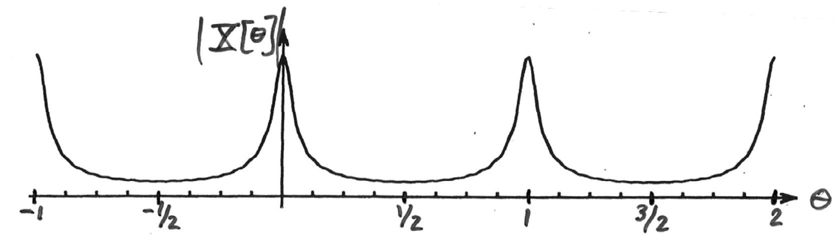




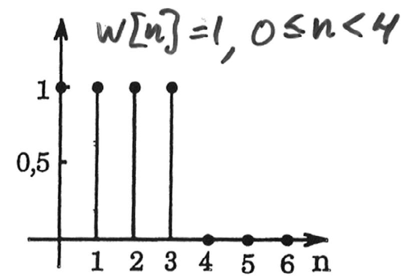
Att använda fönster

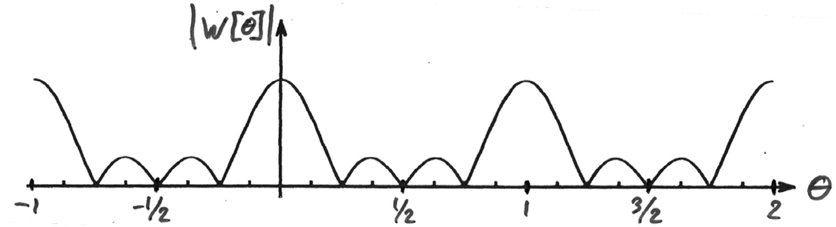
Signal:



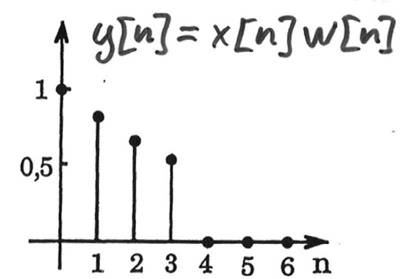


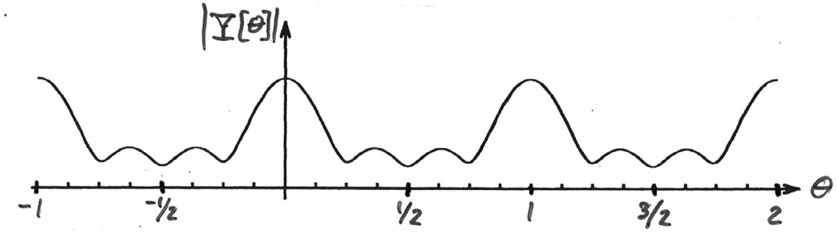
Rektangulärfönster:





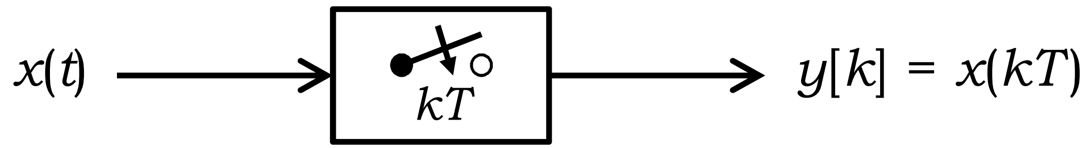
Resultat:



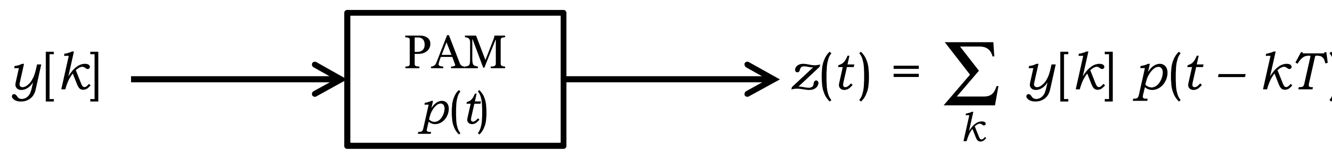


Linjära avbildningar

Sampling:

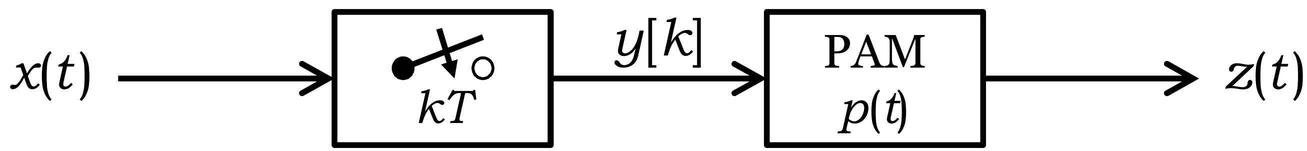


Pulsamplitudmodulering:
(PAM)

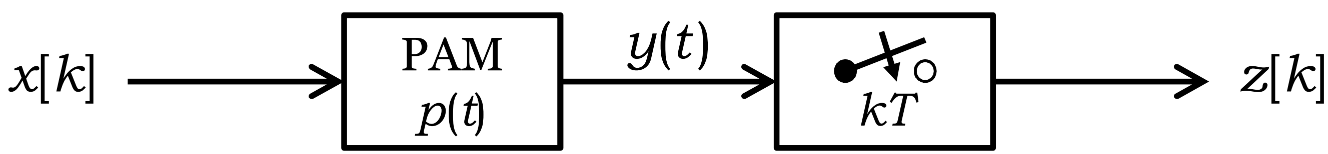


Rekonstruktion:

$t \to k \to t :$



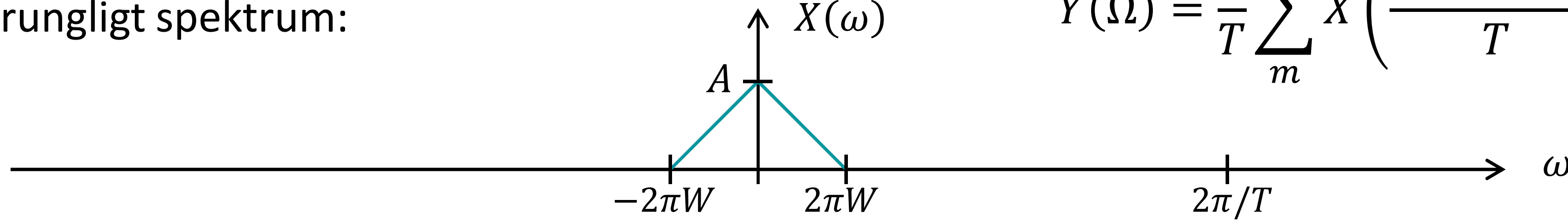
$k \to t \to k :$



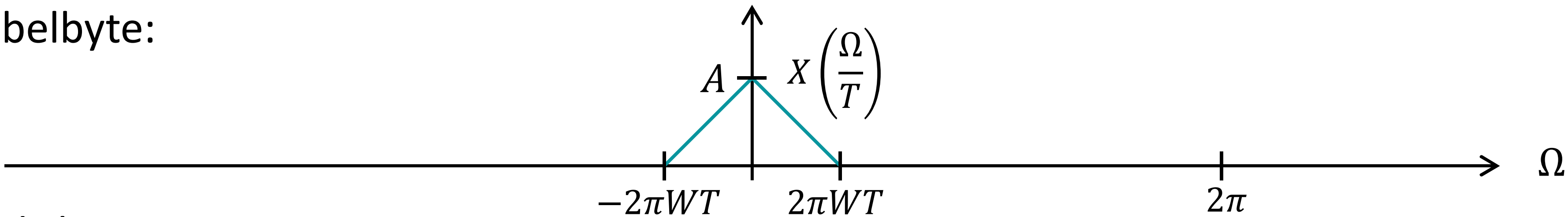
Sampling – Frekvensdomänen

$$Y(\Omega) = \frac{1}{T}\sum_m X\left(\frac{\Omega - m \cdot 2\pi}{T}\right)$$

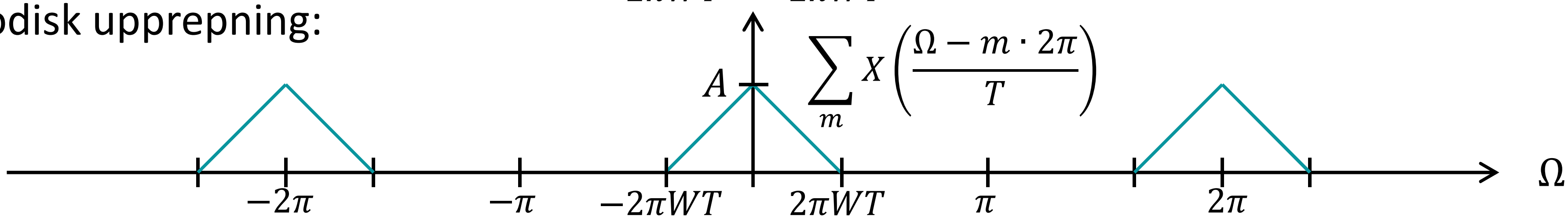
Ursprungligt spektrum:



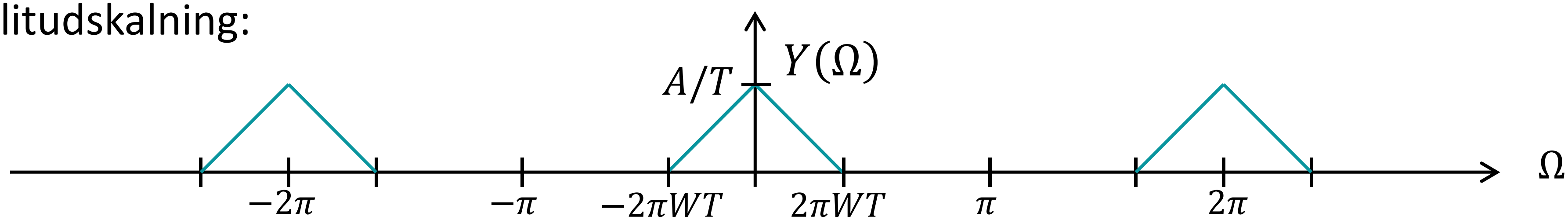
Variabelbyte:



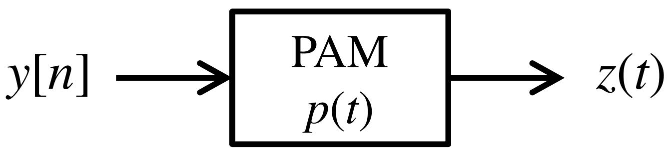
Periodisk upprepning:



Amplitudskalning:



PAM



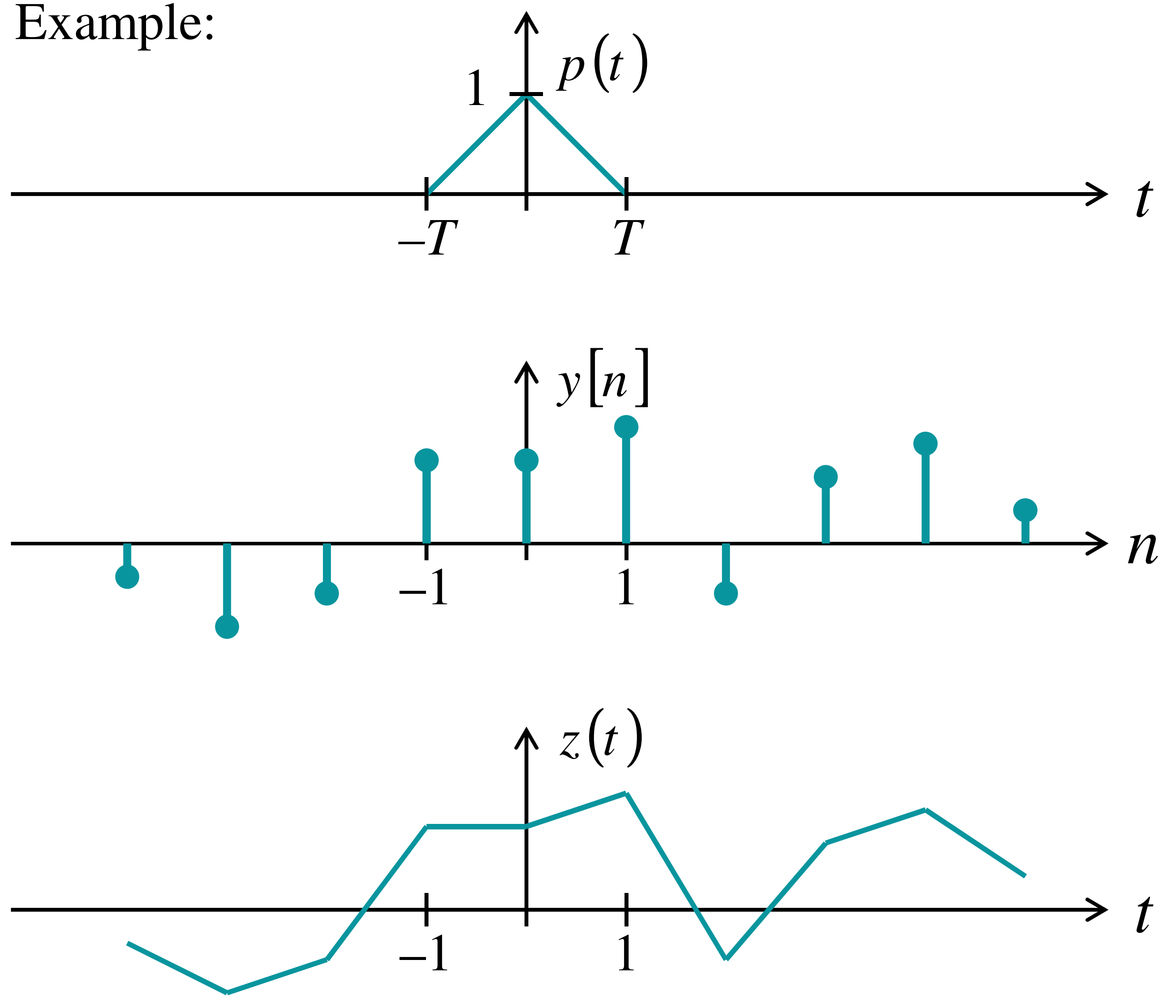
Time domain:

$$z(t) = \sum_{n} y[n]\, p(t - nT)$$

Frequency domain:

$$Z(f) = P(f)\, Y[fT]$$

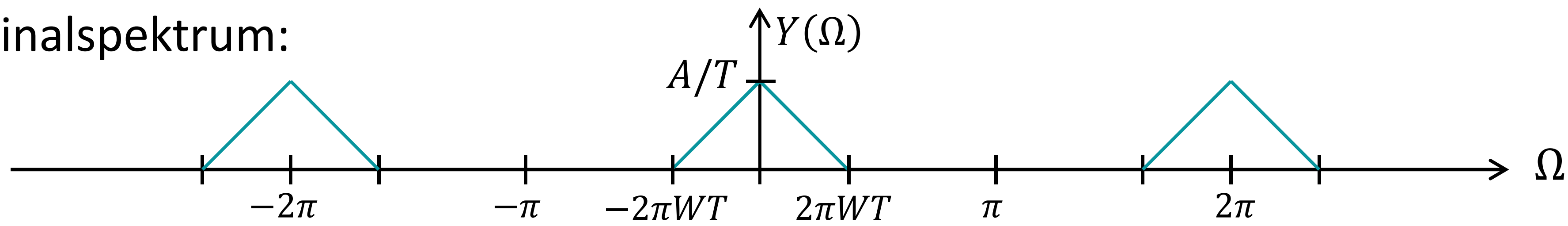
Example:



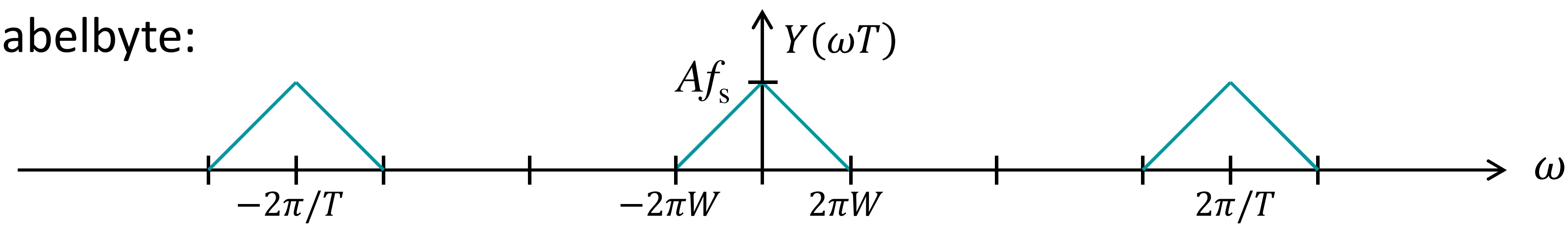
PAM – Frekvensdomänen

$$Z(\omega) = P(\omega)Y[\omega T]$$

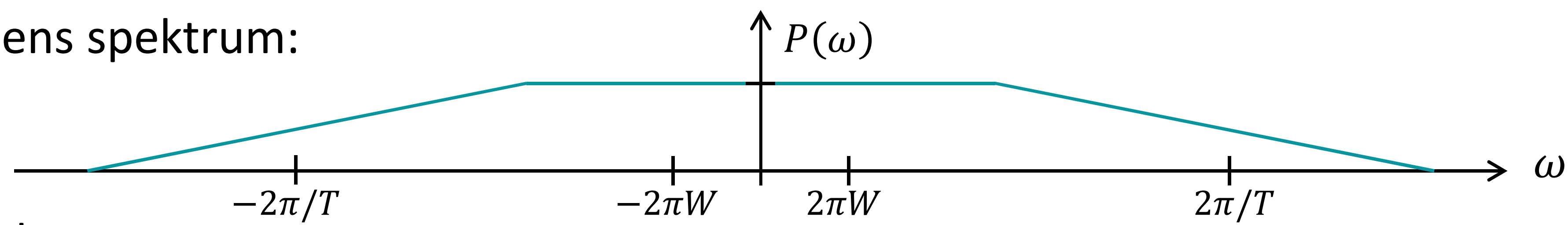
Originalspektrum:



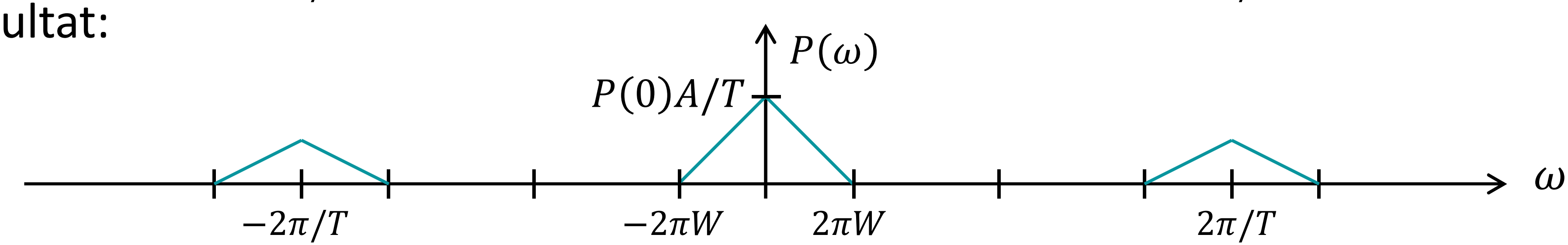
Variabelbyte:



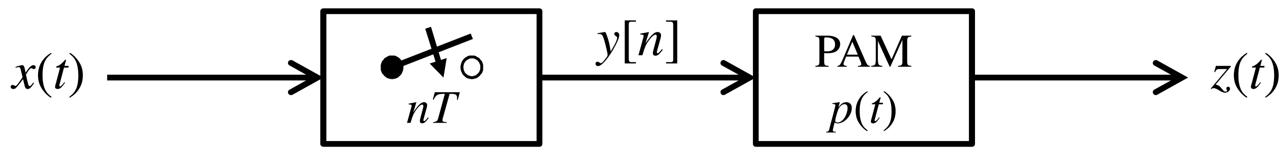
Pulsens spektrum:



Resultat:



Samplingsteoremet



Samplingsteoremet:

Betrakta en signal $x(t)$, med spektrum $X(\omega)$ och $X(\omega) = 0$ för $|\omega| \geq \omega_0$. Om $x(t)$ samplas med samplingsfrekvens f_s, så kan $x(t)$ rekonstrueras utan fel från den samplade signalen om $\pi f_s \geq \omega_0$ gäller.

Detta betyder:

Det finns en pulsform $p(t)$, så att $x(t)$ kan skrivas som

$$x(t) = \sum_n x(nT)\, p(t - nT)$$

om $\pi f_s \geq \omega_0$ gäller, med $f_s = 1/T$.

Detta gäller för:

Ideal rekonstruktion: $p(t) = \text{sinc}(t/T)$

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