Sampling

Aliasing

Rekontruksi

Sinyal

26 September 2018
PENS
Disiapkan oleh: Hary Oktavianto

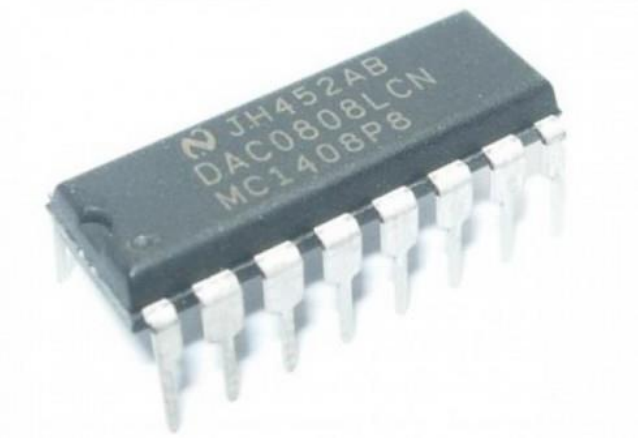
Sampling: mengapa

Mengapa sinyal harus dikonversi?

Pemrosesan sinyal analog dilakukan dalam dunia digital didalam mikroprosesor

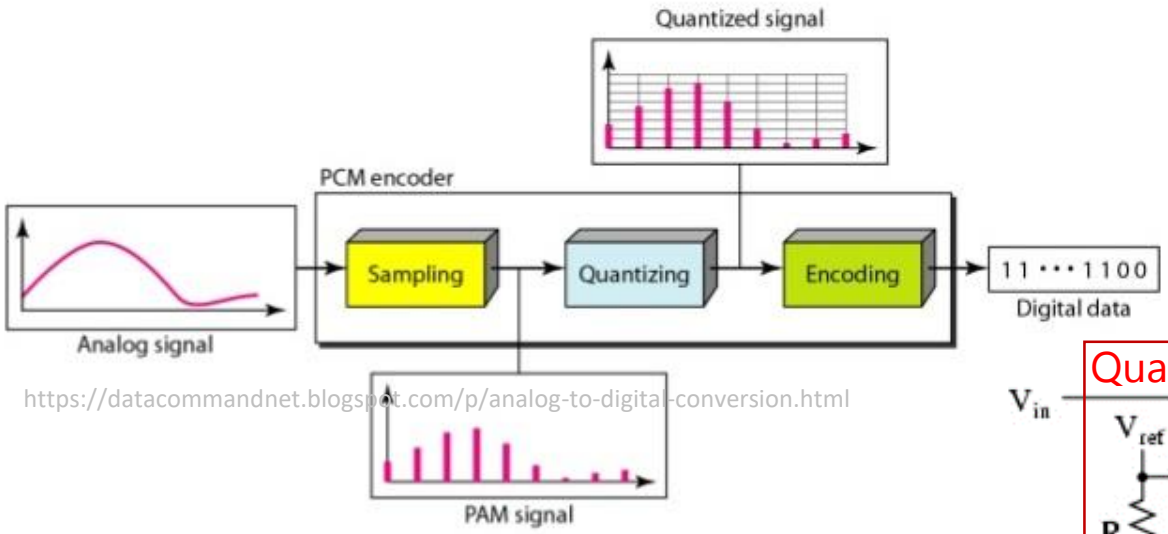
ADC = Analog to Digital Converter

DAC = Digital to Analog Converter

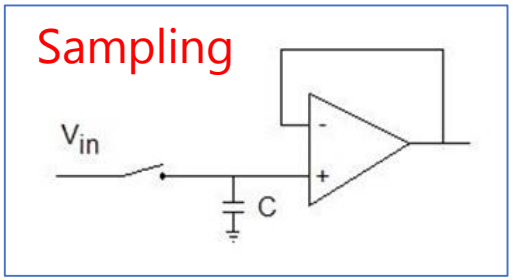


Sumber: Google

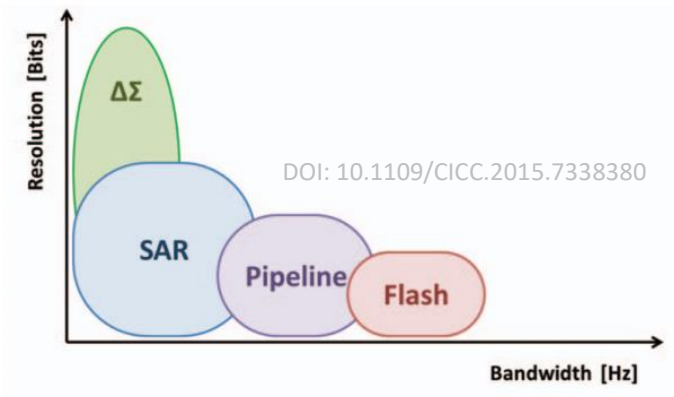
Sampling: kerja ADC



https://datacommandnet.blogspot.com/p/analog-to-digital-conversion.html

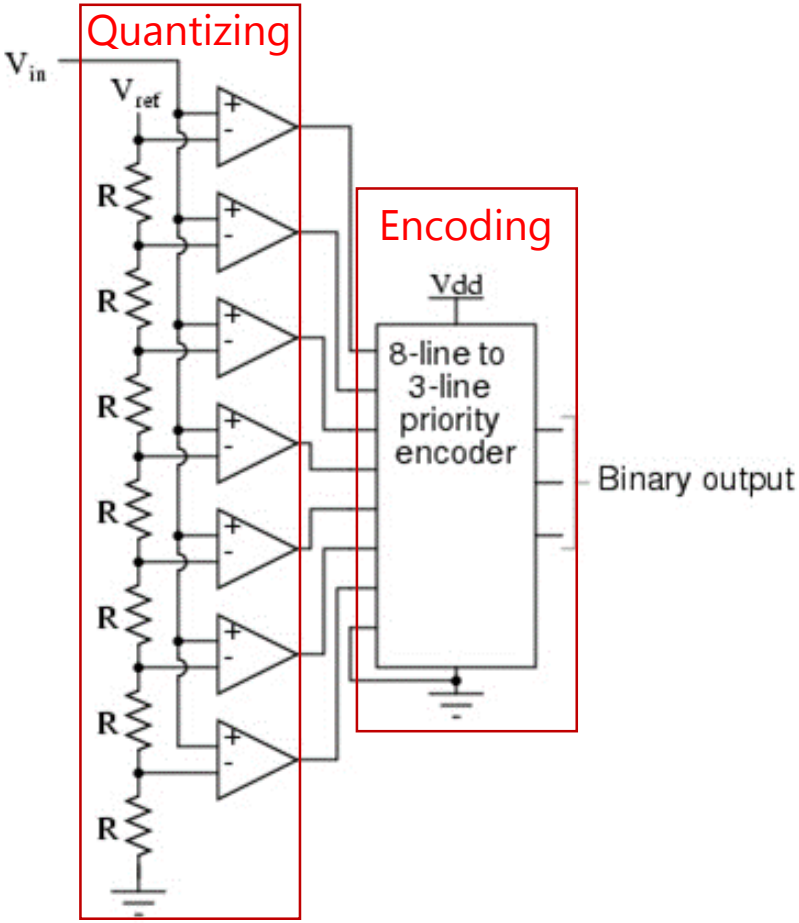


ADC (Analog to Digital Converter)
PCM (Pulse Code Modulation)



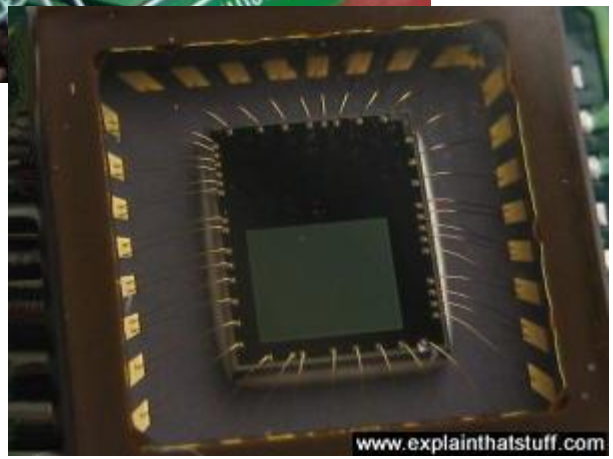
DOI: 10.1109/CICC.2015.7338380

Pilihlah ADC sesuai kebutuhan

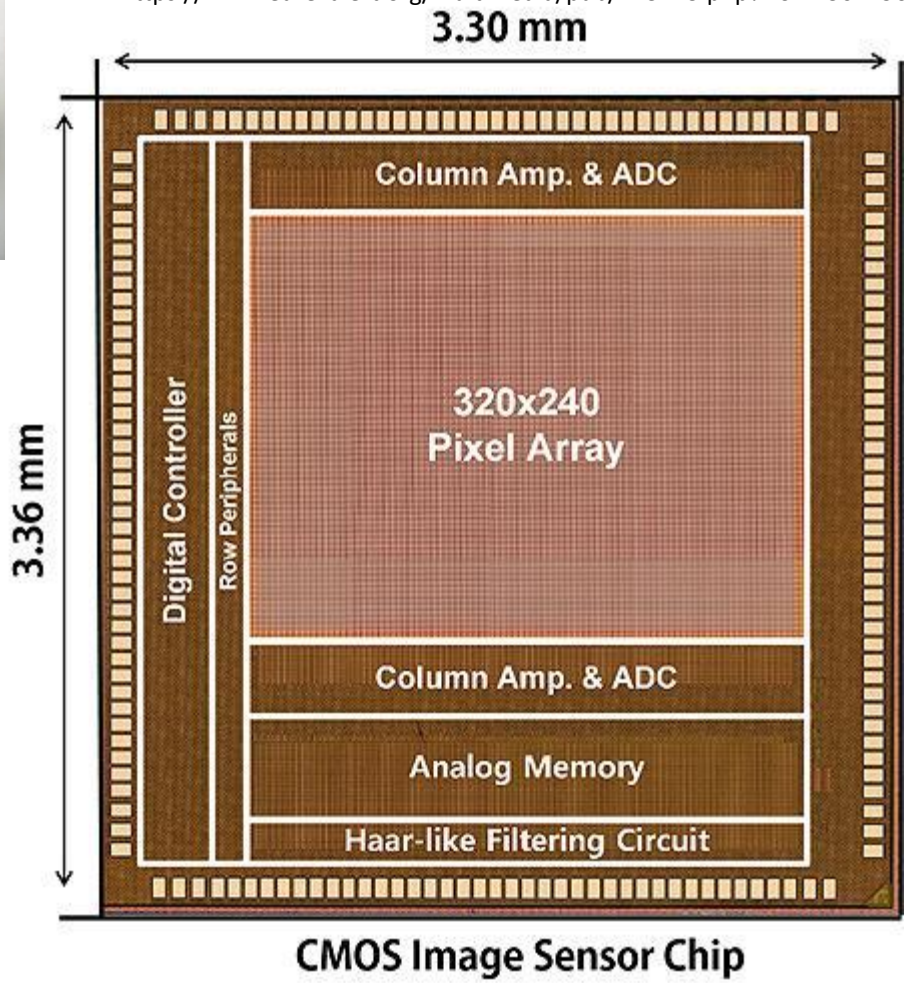


Sampling: sensor

https://www.explainthatstuff.com/webcams.html



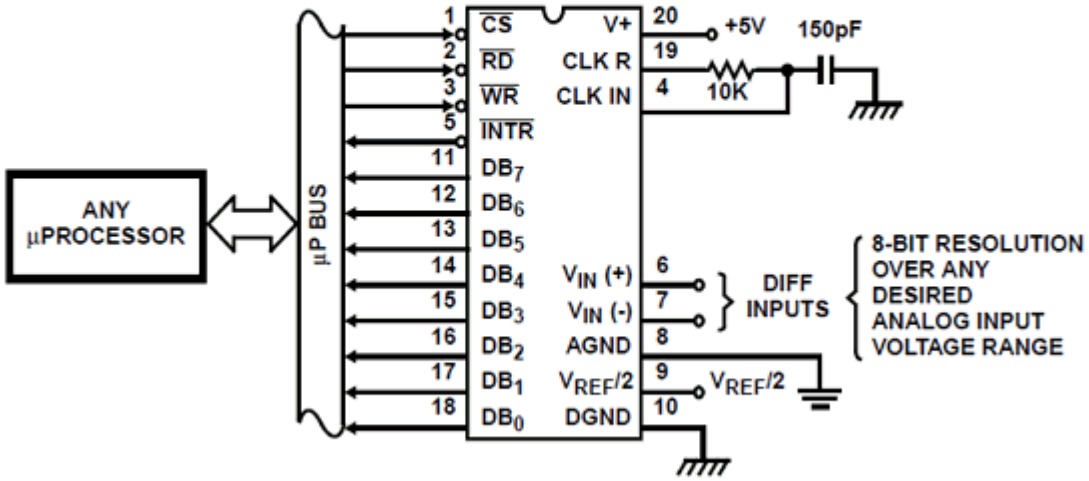
https://www.eurekalert.org/multimedia/pub/143213.php?from=362190



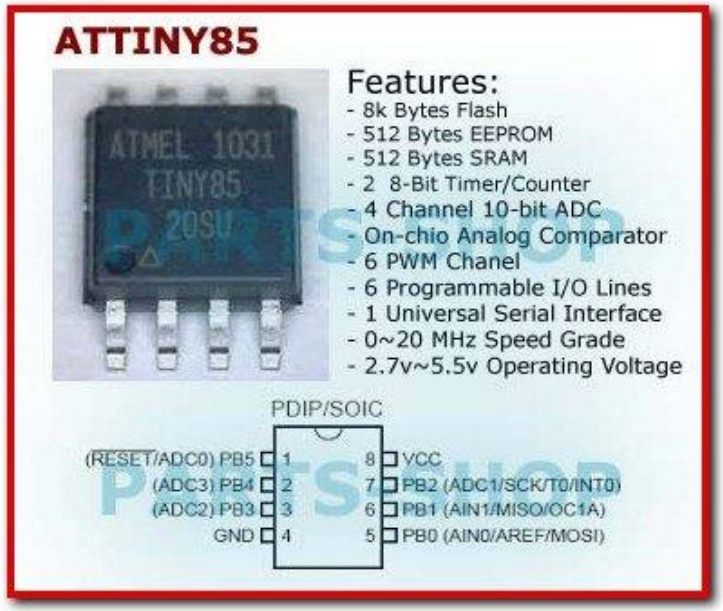
ADC: better inside or not?

ADC0804

http://www.datasheetcafe.com/adc0804-datasheet-ad-converter-intersil/

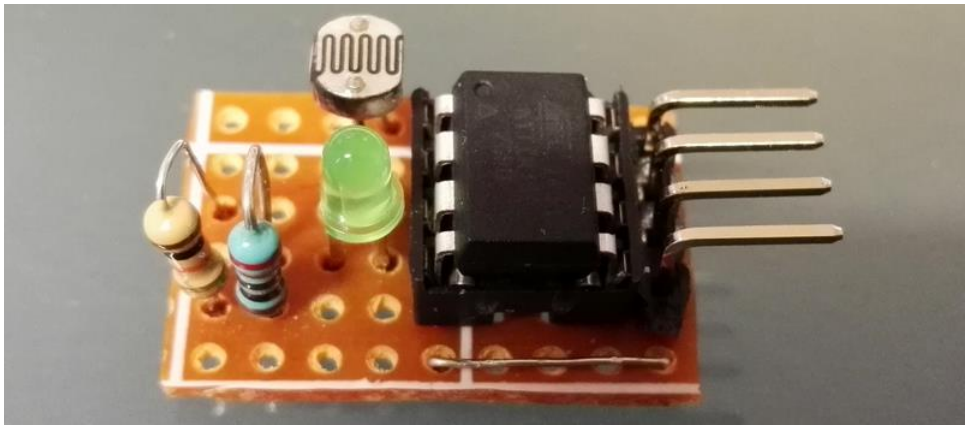


Typical Application Schematic



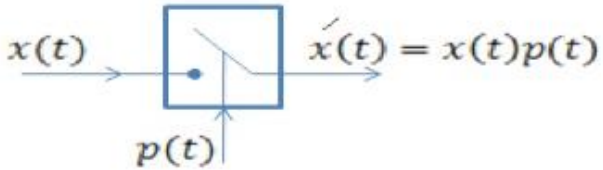
Sumber: Google

https://www.amazon.com/ADC0804-ADC0804LCN-Analog-Digital-converters/dp/B00YKU4WJQ

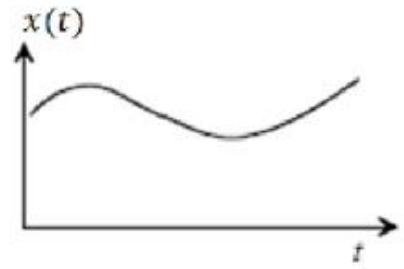


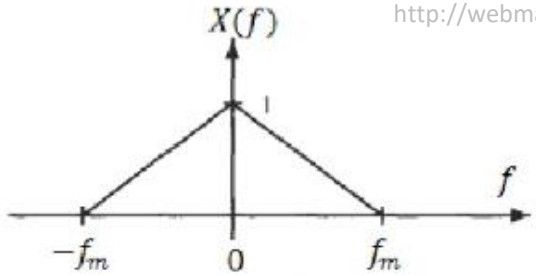
Sampling: mathematics view point

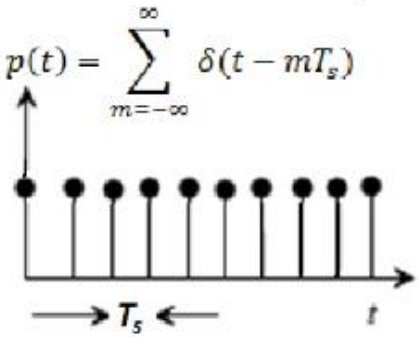
2.2 – Sampling Theorem & Aliasing

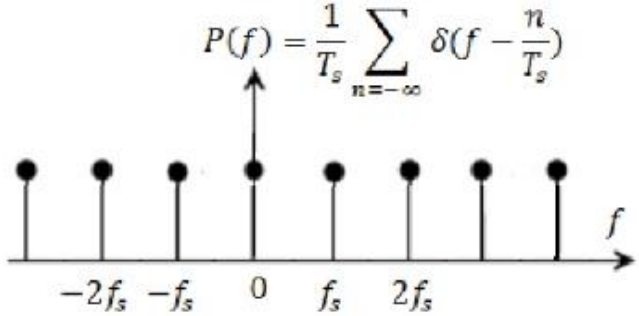


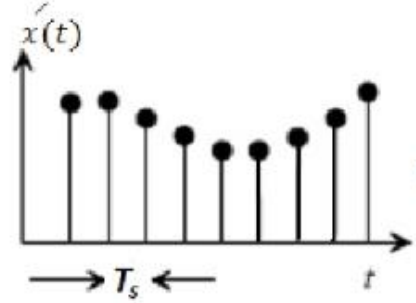
http://webmail.aast.edu/~ebadran/ec533.html

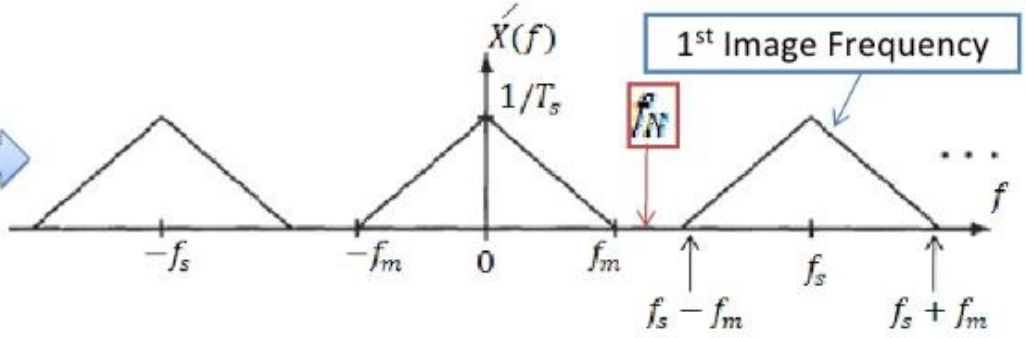








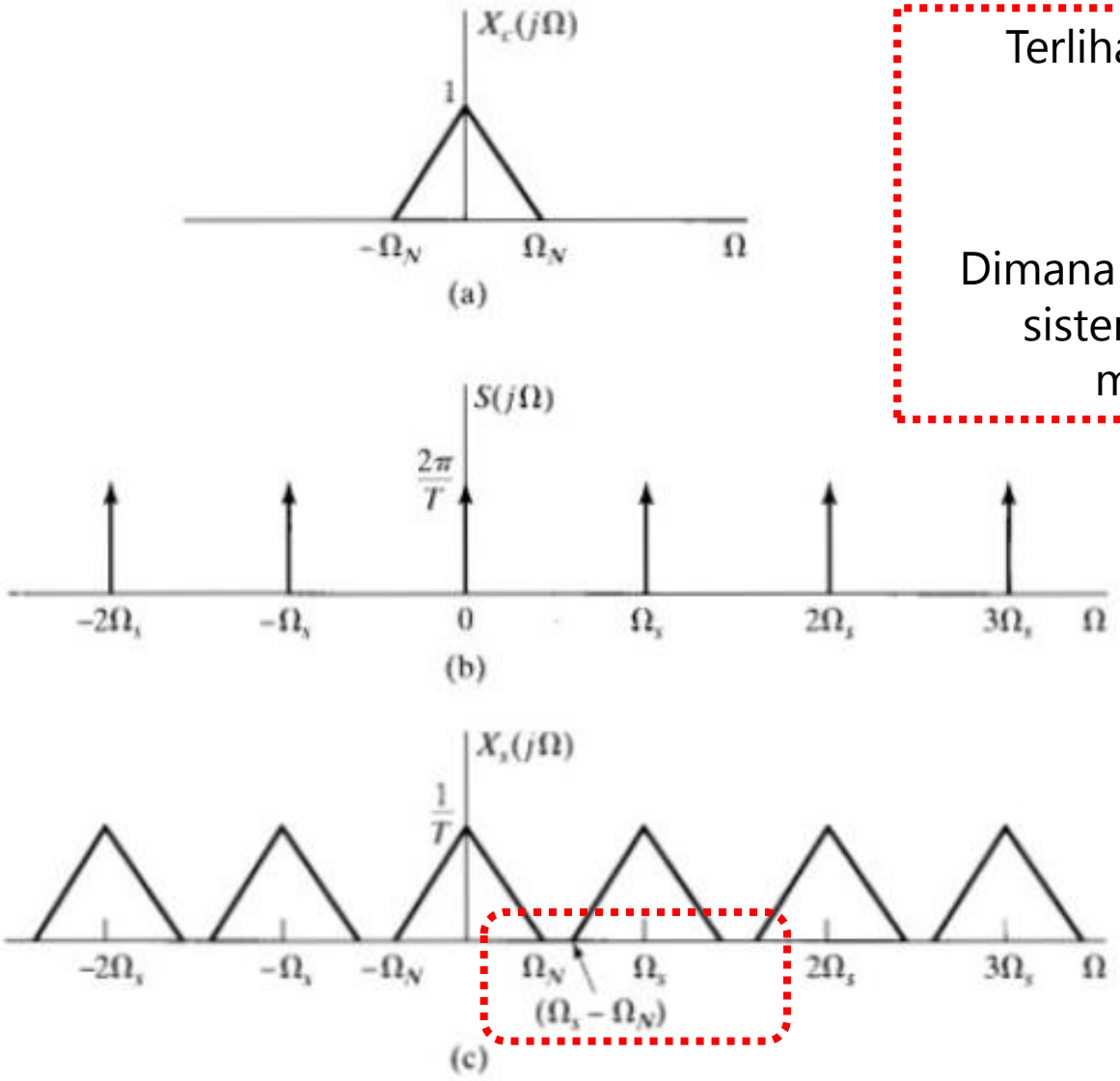




Time Domain

Frequency Domain

Sampling: mathematics view point



*Discrete-time Signal Processing, Oppenheim, Schaffer, Buck

Terlihat pada gambar (c), bahwa:

$$\Omega_S - \Omega_N > \Omega_N$$
$$\Omega_S > 2.\Omega_N$$
$$f_S > 2.f_N$$

Dimana f_S adalah frekuensi sampling sistem dan f_N adalah frekuensi maksimum sinyal input.

$$f_S > 2.f_N$$

Nyquist Sampling Theorem

Nyquist 1928; Shannon 1948, menyatakan:

Let $x_c(t)$ be a bandlimited signal with

$$X_c(j\Omega) = 0 \quad \text{for } |\Omega| \geq \Omega_N.$$

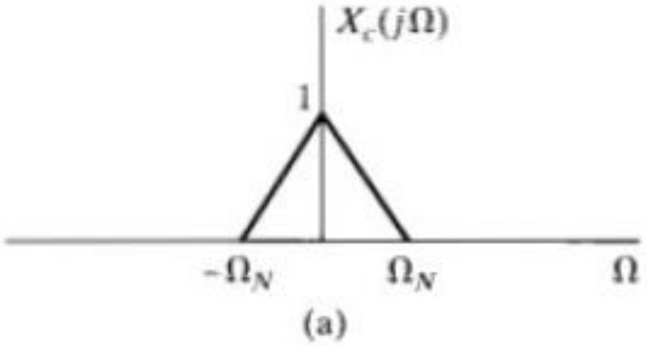
Then $x_c(t)$ is uniquely determined by its samples $x[n] = x_c(nT), n = 0, \pm 1, \pm 2, \ldots,$ if

$$\Omega_s = \frac{2\pi}{T} \geq 2\Omega_N.$$

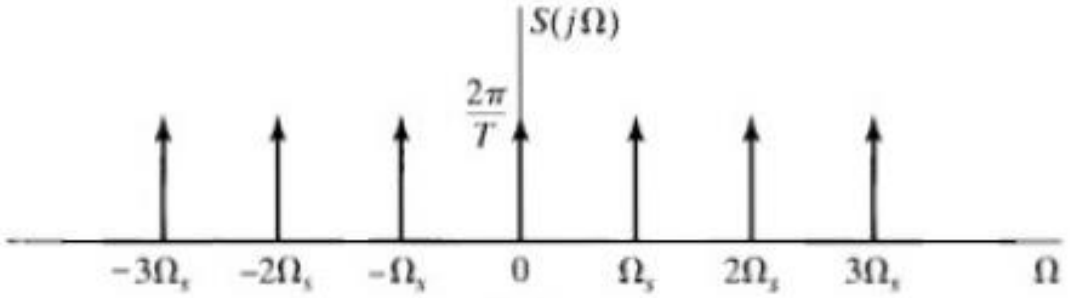
Aliasing

Apa yang terjadi,
bila sampling terlalu lambat?

menyebabkan

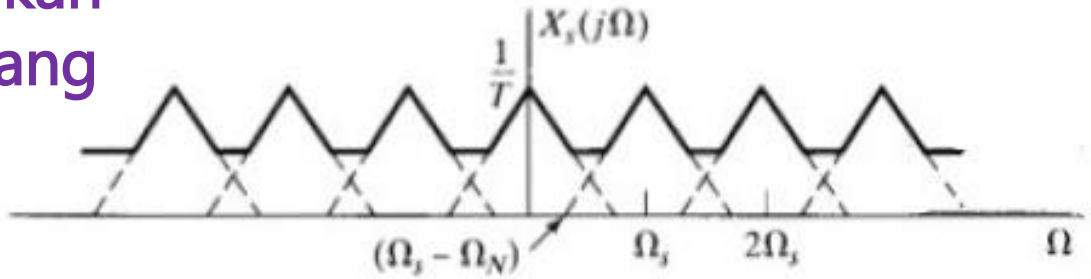


(a)



(b)

Sinyal yang disampling akan terbaca pada frekuensi yang berbeda!

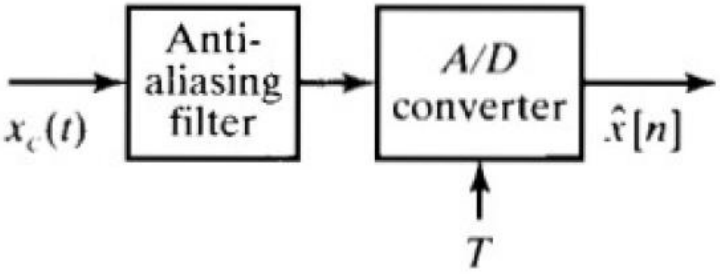


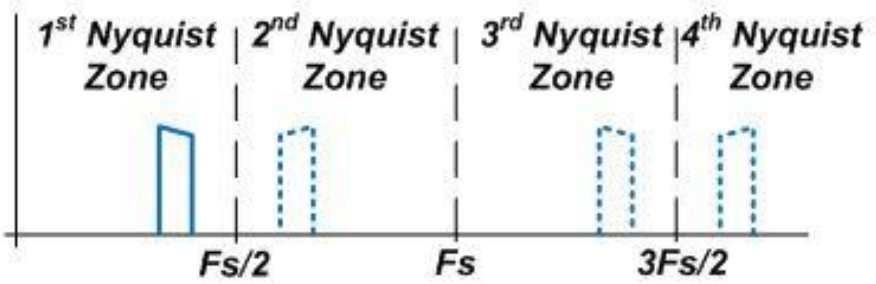
(d)

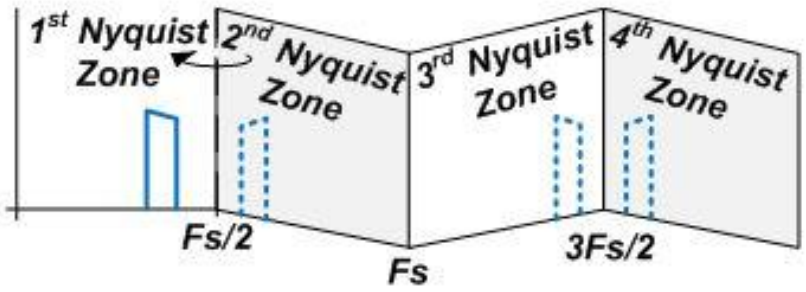
*all pictures are taken from Discrete-time Signal Processing, Oppenheim, Schaffer, Buck

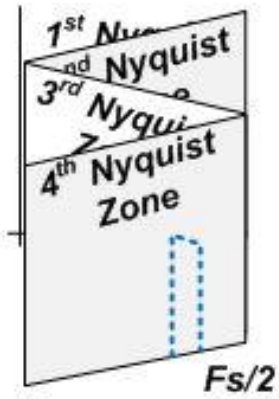
Aliasing: menghindar dan membayangkan

- Patuhi batas Nyquist: $f_S > 2.f_N$ (dalam praktek, gunakan lebih besar dari 2)
- Batasi sinyal yang masuk dengan filter low-pass (filter antialiasing)





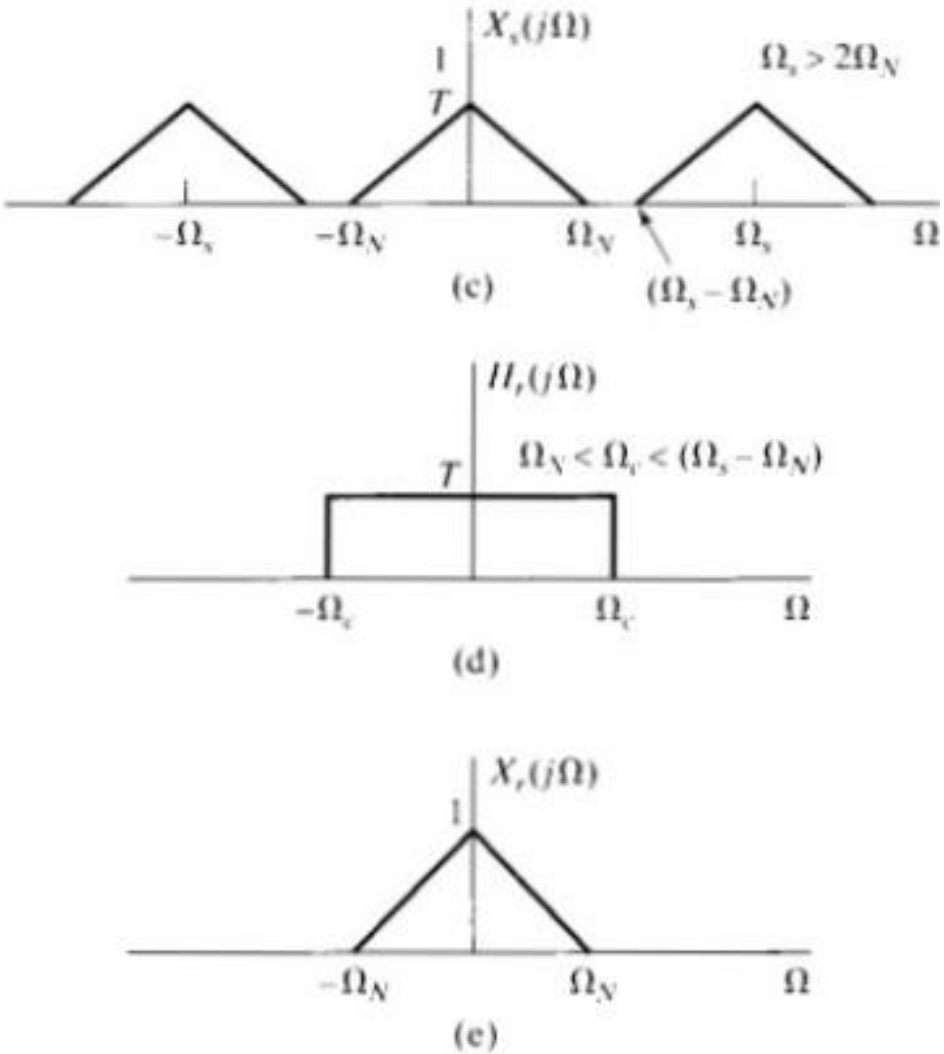


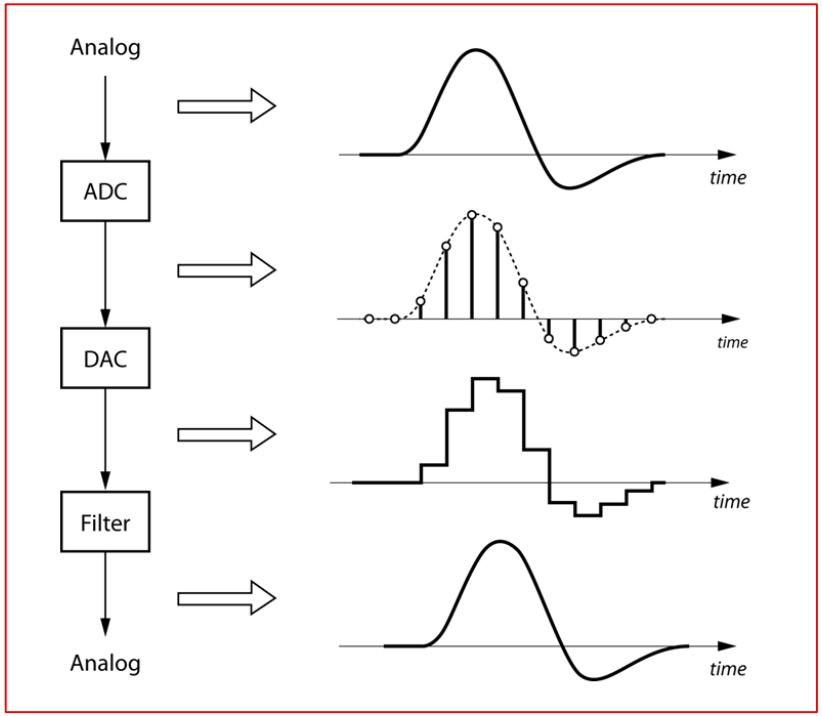


Membayangkan aliasing

Rekonstruksi

Sinyal tersampling yang tidak mengalami aliasing, dapat direkonstruksi secara sempurna menggunakan filter low-pass (filter rekonstruksi) ideal berikut:





http://i.stack.imgur.com/tRjQr.png