PENGOLAHAN SINYAL DIGITAL

Apakah DSP itu???

Definisi Menurut Bores Sign. Proc.

Digital

operating by the use of discrete signals to represent data in the form of numbers

Signal

a variable parameter by which information is conveyed through an electronic circuit

Processing

to perform operations on data according to programmed instructions

Jadi Definisi Menurut Bores Sign. Proc.

Digital Signal Processing / Pengolahan Sinyal Digital is / adalah changing or analysing information which is measured as discrete sequences of numbers / pengubahan atau penganalisaan informasi yang dinyatakan sebagai urutan angka diskrit.

Definisi Menurut NJUST

A. Definition of Signals

- **Signal**: A function of independent variables, which conveys information about state or behavior of a physical system.
- **Independent Variable**: time, distance, speed, position, temperature, pressure, etc.
- **Signal Classification** depends on the nature of the independent variables and the value of the function defining the signal.

△ According to numbers of independent variables, signals can be classified into 1-demensional (1-D) , 2-D, to M-D.

△ According to the value of independent variables, signals can be **Continuous-Time Signals→Analog Signals; Discrete-Time Signals →Digital Signals.**

Definisi Menurut NJUST

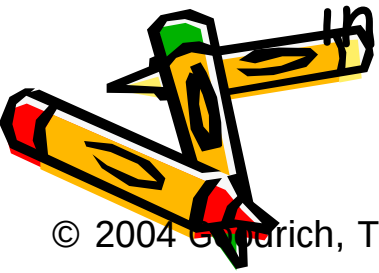
C. Signal processing

Signal processing is concerned with the representation, transformation, and manipulation of signals and information they contain. *(two large types: software algorithms, hardware)*

- **Elementary time-domain operations: delay, scaling (amplification, attenuation), addition**
- **Filtering (lowpass, highpass, bandpass, bandstop filters)**
- **Modulation & Demodulation (AM, FM, PM)**
- **Multiplexing & De-multiplexing (a process of combining narrow-band signals into a wideband signal. e.g. FDM, TDM)**
- **Quadrature Amplitude Modulation**

Jadi Definisi Menurut NJUST

- ***Pengolahan Sinyal*** adalah pemrosesan sinyal yang mempunyai kaitan dengan penyajian, perubahan bentuk, dan manipulasi dari isi sinyal dan informasi
- ***Pengolahan Sinyal Digital*** adalah pemrosesan sinyal yang mempunyai kaitan dengan penyajian, perubahan bentuk, dan manipulasi dari isi sinyal dan informasi dalam bentuk digital



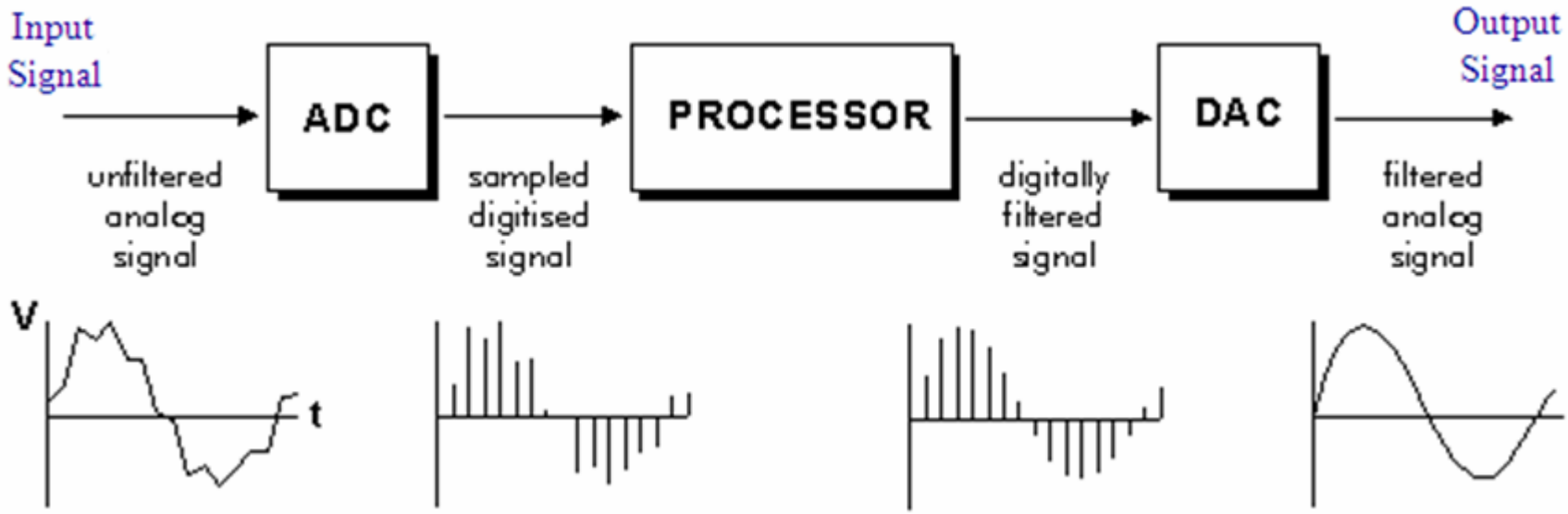
Apa DSP?

- Sinyal, isyarat → alami buatan
- Sinyal → perlu (suara/percakapan), menyenangkan (musik), tidak dikehendakai pada saat-saat tertentu
- Sinyal membawa informasi yang dibutuhkan maupun tidak → pemrosesan sinyal → memisahkannya
- Secara umum:

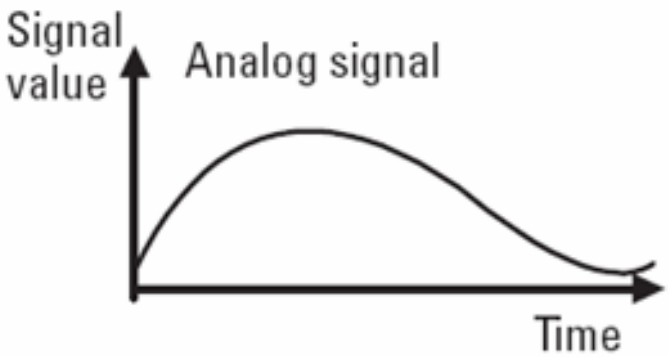
  Pemrosesan sinyal merupakan operasi yang dirancang untuk meng-ekstark, meningkatkan, menyimpan dan mengirimkan informasi yang bermanfaat

What is DSP?

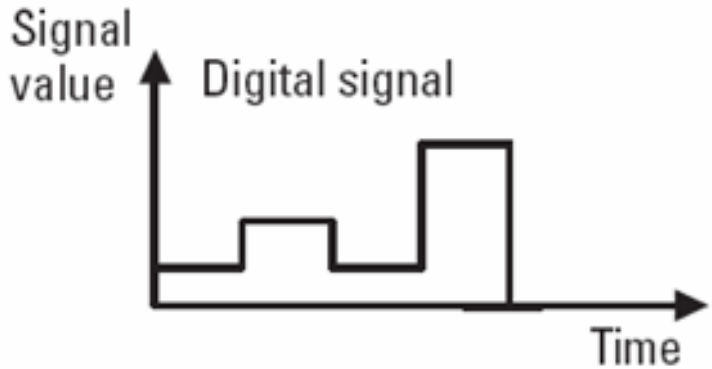
- **Digital Signal Processing** – the processing or manipulation of signals using digital techniques



Sinyal analog vs Sinyal Digital



Sinyal analog memiliki jumlah kemungkinan nilai amplituda yang tak terhingga



Sinyal digital memiliki jumlah kemungkinan nilai amplituda yang terhingga

Kelebihan Sinyal digital Vs Sinyal Analog

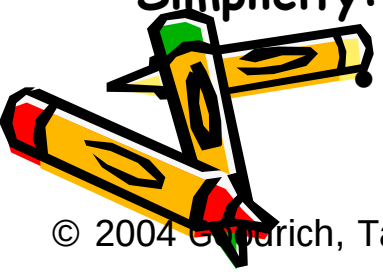
- Kelemahan PSA:

  aplikasi pemrosesan sinyal lebih kompleks

- Kelebihan PSD:
  - Sistem yang digunakan PSD dapat dikembangkan menggunakan perangkat lunak yang berjalan dengan PC
  - Operasi PSD dapat lebih mudah untuk dimodifikasi
  - Lebih murah

Keuntungan DSP Menurut Bores Sign. Proc.

- **Versatility:**
  - digital systems can be reprogrammed for other applications (at least where programmable DSP chips are used)
  - digital systems can be ported to different hardware (for example a different DSP chip or board level product)
- **Repeatability:**
  - digital systems can be easily duplicated
  - digital systems do not depend on strict component tolerances
  - digital system responses do not drift with temperature
- **Simplicity:**
  - some things can be done more easily digitally than with analogue systems



Keuntungan DSP Menurut NJUST

E. Advantages of Digital signal processing

- Robust (signal levels can be regenerated)
- Easy and lasting storage capability ($\Rightarrow$ off-line computations)
- Tunable (digital adaptive filters)
- Easy interconnection of blocks (No loading problem)
- Possibility to share a processor between several tasks

But

- Additional complexity (A/D and D/A)
- Limit in frequency

Kategori PSD

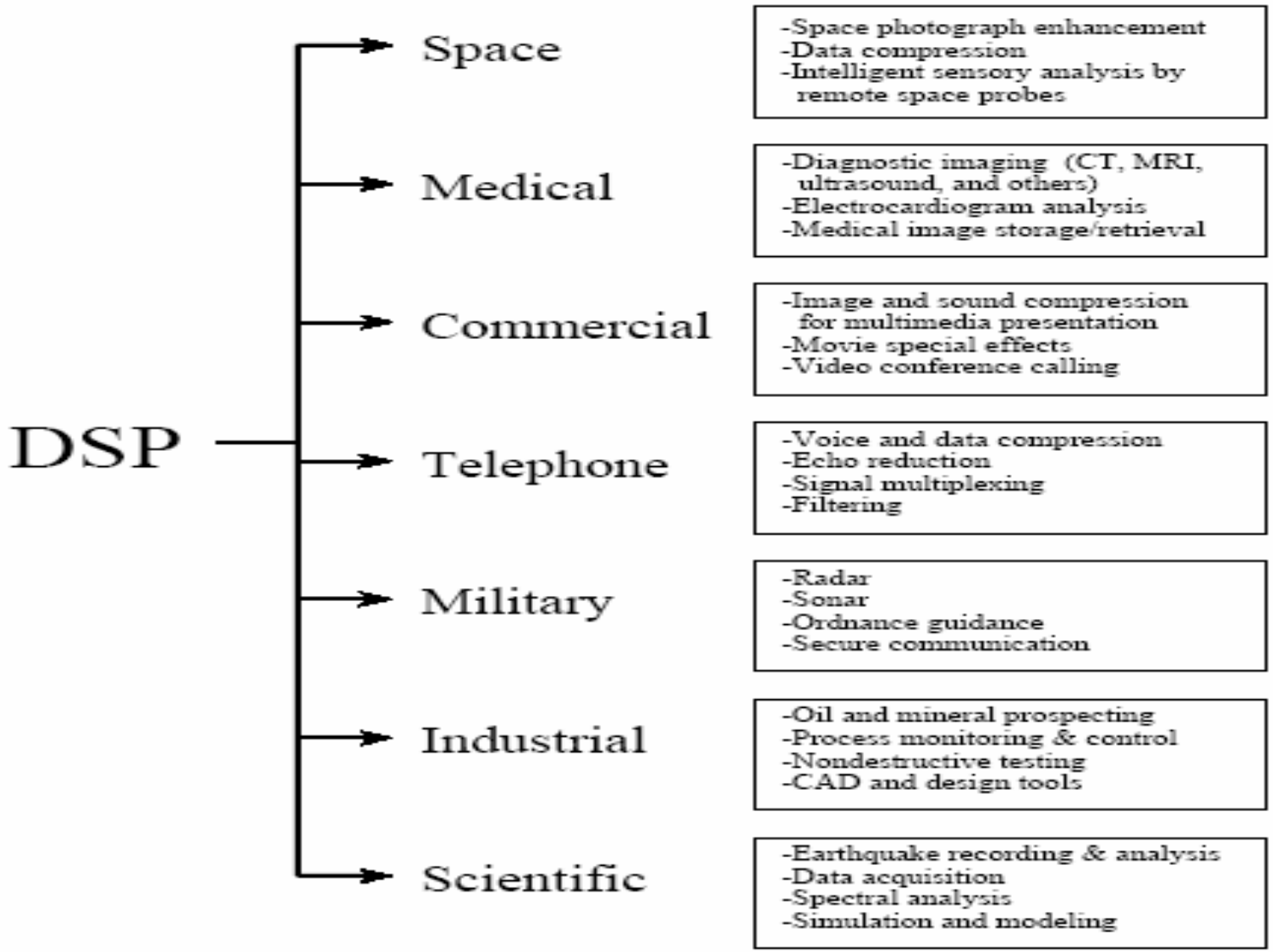
- Analisa Sinyal

  berkaitan dengan pengukuran sifat-sifat sinyal

- Penapisan Sinyal (Digital Filter)

  situasi “sinyal masuk-sinyal keluar”, dalam ranah waktu pada umumnya
  -Menghilangkan derau
  -Menghilangnken interfensi
  -Memisahkan pita-pita frekuensi

Aplikasi DSP

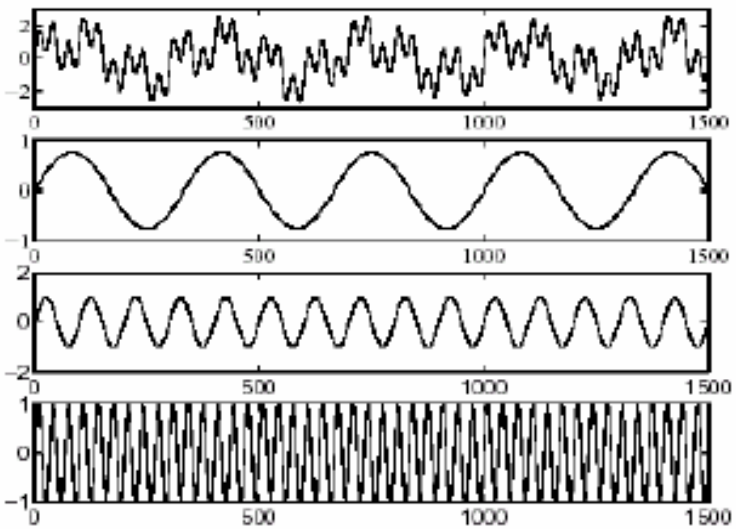


Aplikasi DSP (1)

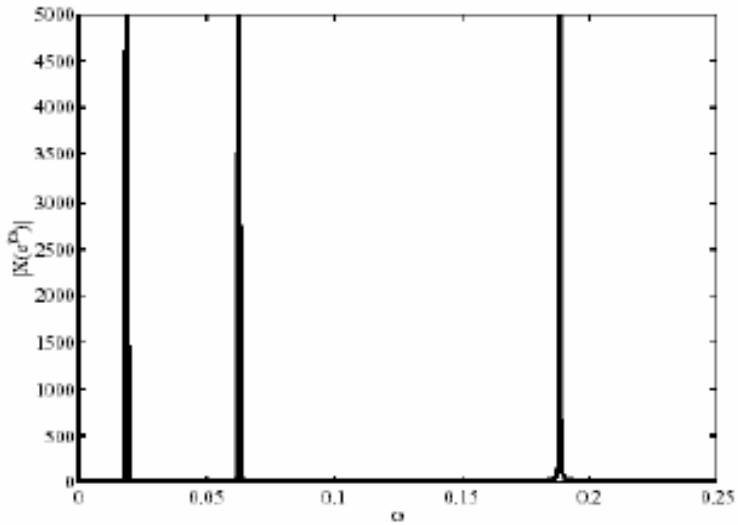
F. Applications of DSP

Example of frequency-selective filtering:

Multiple sines



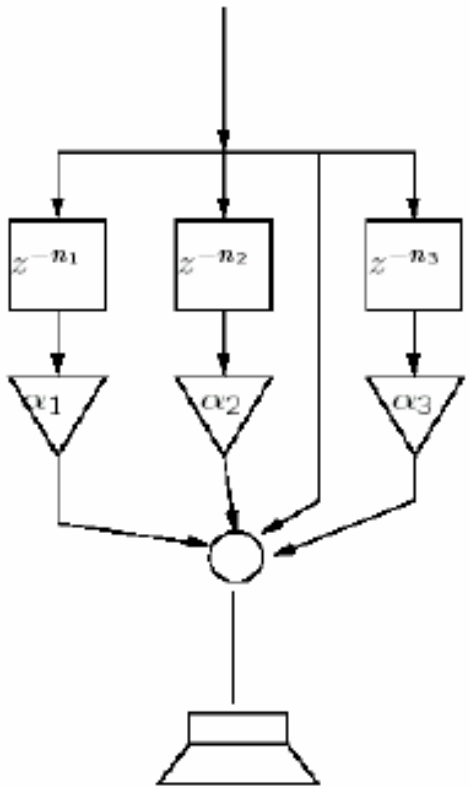
Corresponding frequency representation $|X(e^{j\omega})|$



Aplikasi DSP (2)

Applications: Sound

- Equalization: selectively enhance/attenuate some part of the frequency spectrum
- coding and compression
- room simulation, echo or chorus effects



Aplikasi DSP (3)

Applications: time-series prediction

Predict a future value of a time-series from its samples: $\hat{x}[n+1]$ from $x[0] \ldots x[n]$?

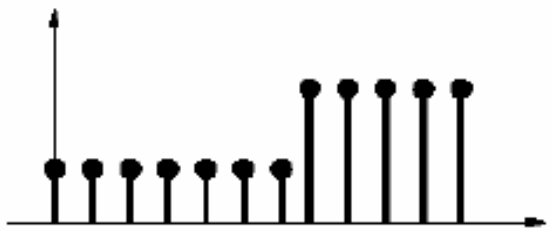
Uses a so-called "prediction filter" that evaluates $\hat{x}[n+1]$.

Aplikasi DSP (4)

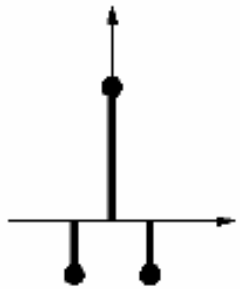
Applications: Image Processing

Edge detection principle:

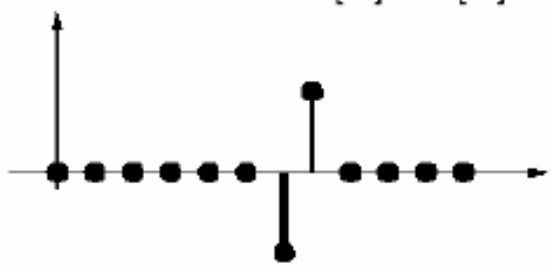
Edge signal $x[n]$



Edge detecting filter $h[n]$



Convolution $x[n] * h[n]$:



Referensi

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4. J. G. Proakis and D. G. Manolakis, ***Digital Signal Processing ; Principles, Algorithms and Applications*** ; MacMillan Publishing, 1992. ISBN 0-02-396815-X

Kaitan DSP dengan bidang Ilmu lain