Digital Signal Processing

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Lecture 4 - Topics

Classification of Systems :

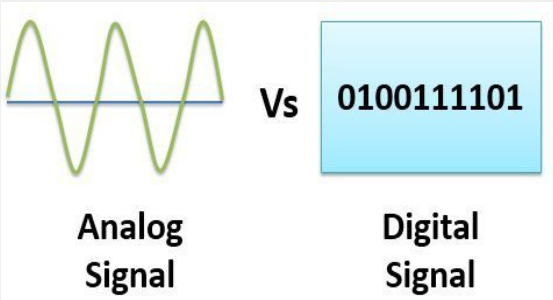
Static and Dynamic

Time variant and invariant

Casual and non-Casual

Invertible and non invertible

Stable and unstable



Introduction

- "A set of connected parts or models which takes discrete-time signals as input, known as **excitation**, processes it under certain set of rules and algorithms to have a desired output of another discrete-time signal, known as **response**".
- In general, if a there is excitation x(n) and the response of the system is y(n), the we express the system as, $y(n) = T[x(n)]$
- Where, **T is the general rule or algorithm** which is implemented on x(n) or the excitation to get the response y(n).

Static and Dynamic

- A system is said to be a Static discrete-time system if the response of the system depends at most on the current or present excitation and not on the past or future excitation. The static systems are also said to be memory-less systems
- If there is any other scenario then the system is said to be a Dynamic discrete–time system. The dynamic systems have either finite or infinite memory depending on the nature of the system.

Time variant and invariant

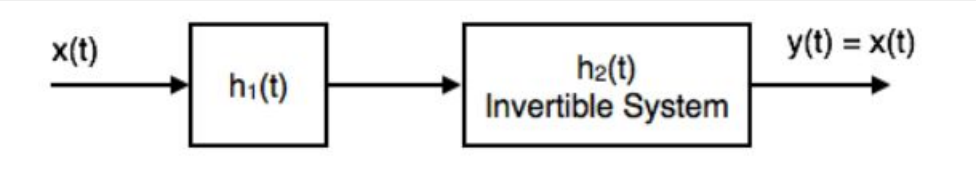
- A system is said to be time variant if its input and output characteristics vary with time. Otherwise, the system is considered as time invariant.
- The condition for time invariant system is:
- $y(n, t) = y(n-t)$
- The condition for time variant system is:
- $y(n, t) \neq y(n-t)$
- In order to check whether the system is time-invariant or time-variant the system must satisfy the "T[x(n-k)]=y(n-k)" condition, i.e. first delay the excitation by k units, then replace n with (n-k) in the response and then equate L.H.S. and R.H.S. if they are equal then the system is time invariant otherwise not.

Causal and non-Causal

- A discrete-time system is said to be a causal system if the response or the output of the system at any time depends only on the present or past excitation or input and not on the future inputs.
- A non-causal system has its response dependent on future inputs also which is not physically realizable in a real-time system but can be realized in a recorded system.

Invertible and Non-Invertible

A system is said to invertible if the input of the system appears at the output. Else it is non invertible system



Stable and Unstable

- A system is said to be stable if the response of the system depends at most on the current or past excitation and not on the future excitation.
- If if the response of the system depends on the current, past excitation and the future excitation, it is an unstable system.

Thank you