ECE 6200 Lecture II Definitions

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Definition 0.1 (SISO). *A SISO or Single Input Single Output is a type of system with only one input or output.*

Definition 0.2 (MIMO). *A MIMO or Multiple Input Multiple Output is a type of system with more than one input or output.*

Definition 0.3 (Continuous-Time System). *A **continuous-time system** with signals that are defined at every time instance* $t \in \mathbb{R} \to u(t)$ *and* $y(t)$.

Definition 0.4 (Discrete-Time System). *A **discrete-time system** with signals that are only defined at discrete time instants* $kT, k \in \mathbb{Z} \to u[k] := u[kT]$ *and* $y[k] := y[kT]$.

- $T \in \mathbb{R}$ *is a fixed sampling time.*

Definition 0.5 (Static Systems). ***Static Systems** are memory-less systems whose output* $y(t_0)$ *at time* $t = t_0$ *depends on the input* $u(t_0)$ *at that time only. That is, it is independent of inputs at past or future times.*

Definition 0.6 (Dynamical Systems). ***Dynamical Systems** possess memory as a result of which their output* $y(t_0)$ *at time* $t = t_0$. *In other words, their present output may depend on past or future inputs.*

Definition 0.7 (Casual Systems). ***Casual Systems** are example of dynamic system whose output depends upon past or current inputs, but not on future inputs are casual systems.*

Definition 0.8 (State of a System). *The **state*** $x(t_0)$ *of a system at time* $t = t_0$ *is the information at* t_0 *that, together with the input* $u(t)$, *for* $t \geq t_0$, *determines uniquely the output* $y(t)$ *for all* $t \geq t_0$

Definition 0.9 (Lumped System). *A system is said to be a **lumped system** if its state variables are finite.*

Definition 0.10 (Distributed System). *A system is known as a **distributed system** if it has infinite state variables.*

Definition 0.11 (Linear System). *A system is known as a **linear system** via the **superposition principle** that satisfies both the **additivity** and **homogeneity** properties.*

Definition 0.12 (Nonlinear System)**.** *A system is known as a* ***nonlinear system*** *if it does not satisfy the superposition principle.*