Course System Dynamics / Control / Control Technique   Fall 2010/11

Terms and Definitions

System:
Purpose oriented part of the real world. The system is in interaction with the real world, whereby from the real world inputs are acting to the system and outputs are acting from the system to the environment.

Physical variables / physical values:
Interaction qualities (qualities / states) within a system or from the system to the environment, in technical systems usually of physical nature. Physical values are usually defined in connection with the purpose of related systems to be considered. The variables to be considered in control are usually scalars or vectors. The main property of variables considered within system dynamics or control is the time depending behavior.

Control variable / Output (single input – single output system):
Variable of the system to be controlled. The variable should be usually fix or variable. In Single Input - Single Output (SISO) systems the output (here only one exists) is the control variable.

Open loop system:
Open loop systems are working so that the inputs of the systems are affecting the outputs depending on the dynamic properties of the system and **not** vice versa. The characteristic property of an open loop system is the non closed behavior of the signal flow.

Closed loop system:
Within a closed loop system the control variable is usually online measured and compared with a given desired / reference variable (which also can be zero). The result is given to the input in the way that it is acting so that the control variable tends to the desired value.
This realizes the feedback and closes the loop.
The characteristic property of a closed loop system is the closed behavior of the signal flow. This changes the dynamic behavior of the overall system and allows the automatic compensation of disturbances acting to the system and affecting the control variable.

Disturbance (variable / value):
From the environment to the system acting variable, which influences the control variable in an unwanted way.

Input (variable / value):
Variable acting direct to the system and changes the output of the system. In open loop system the input variable acts from the environment to the system, in closed loop systems the input is the output of the controller and the input of the system to be controlled.

Desired variable /value / reference variable/value:
Variable from the environment to the controller, which gives the reference for the output as the value to be controlled.

Control deviation / control difference:

Variable denoting the difference between the desired and the control variable. The control deviation is an internal variable inside the controller.

Plant (system to be controlled):
The plant is the system to be controlled (closed loop) or the system to be affected by the input (open loop).

Controller:
The controller is the part of the system, which affects the plant using an actuator. From a practical point of view controller and actuator are distinguished, from a theoretical point the control unit combines the control and the actuator and is called controller. From a practical point of view the technical control unit often also consists of the unit for comparison of desired and control variable.

Transfer element:
Abstract understanding of a general system with dynamic properties, which can be the system to be controlled or the controller or another element of the transfer chain. The important aspect is that the transfer element is a system, whereby the dynamic properties of the transmittance from input to output are of interest. The relevant aspect is the dynamic characterization of the transfer behavior. Plant and controllers are in this way nothing more than transfer elements, the denotation plant or controller results from the function of the transfer element within the loop.

Transfer system:
Abstract understanding of a set of elements building up a new element > system.

Actuator:
Actuator is the physical device in front of the plant used for physical excitation of the plant to affect the plant. In the theoretical / abstract consideration the actuator is part of the transfer element controller.

Measurement device:
The physical device used for measuring of the output / the control variable is called measurement device / unit. In the theoretical / abstract consideration the dynamical properties of usual neglected, so the measurement device is understand is an ideal transfer element without any kind of dynamic properties. For practical considerations the dynamics properties of the measurement unit as well as of the actuator has to be considered.

Reference value:
Parameter of the reference variable

Control value:
Parameter of the control variable

Remark:
The given terms and definitions are used from different authors etc. in a different way.

The important aspect is the verbal separation from signals and physical variables, from systems and behaviors, from the physical/technical realization and from the mathematical abstract mapping, for example using equations by distinguishing terms. This is especially realized by terms and definitions.
In older text books and practical oriented literature this distinction is often not realized.
It is a good idea to understand the clear separation between reality, mapping and mathematical representation to be open for future advanced information science oriented control and interaction approaches.