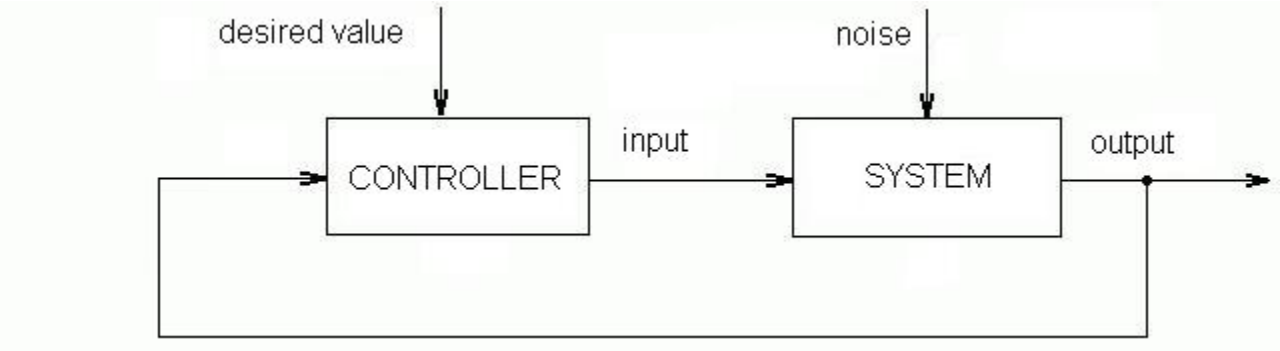
Theory of the Decision Making



Outlines:

- unified logical structure
- big application range
- the top-down style of presentation

Main parts of DM:

- modelling
- estimation of model parameters
- optimal control

A Bayesian approach to the decision making

Notation:

$$\begin{array}{lcl} d_t & = & [y_t, u_t]' \\ d(t) & = & [d_t, d_{t-1}, \ldots, d_0] \\ \psi(t) & = & [u_t, y_{t-1}, u_{t-1}, \ldots, y_{t-n}, u_{t-n}] \end{array}$$

Data set description and decomposition:

$$\begin{array}{rcl} f(d_N, \ldots, d_1|d_0) & = & \Pi_{\tau=1}^{N} f(d_\tau|d(\tau-1)) = \\ & & \\ & = & \Pi_{\tau=1}^{N} f(y_\tau|u_\tau, d(\tau-1)) f(u_\tau|d(\tau-1)) \end{array}$$

Parameterization:

$$f(y_\tau|u_\tau, d(\tau-1)) = \int_{\Theta^*} f(y_\tau|\psi_\tau, \Theta) f(\Theta|d(\tau-1)) d\Theta$$

Bayes rule - iterative description of the parameters:

$$f(\Theta|d(\tau)) \propto f(y_\tau|\psi_\tau, \Theta) f(\Theta|d(\tau-1))$$

Optimality criterion:

$$J = \sum_{\tau=1}^{N} (y_\tau^2 + \omega u_\tau^2)$$

Scheme of DM tasks:

- Decomposition of quantities
- Admissible decision rules
- Loss function used for optimal decisions

DM tasks:

- point estimation
- set estimation
- testing of hypotheses
- one-step-ahead prediction
- one-step-ahead control
- sequential estimation
- multi-step-ahead prediction
- filtering of variables
- multi-step-ahead control