## State estimation - linear model

Generally, the state evolution is described in pdfs

$$f\left(x_{t-1}|d\left(t-1\right)\right)\underbrace{\rightarrow}_{\text{prediction}}f\left(x_t|d\left(t-1\right)\right)\underbrace{\rightarrow}_{\text{filtration}}f\left(x_t|d\left(t\right)\right)$$

where $f\left(x_i|d\left(j\right)\right)$ means description of the state $x_i$, at time $i$, using information from data $d\left(j\right)$, collected from the beginning up to and including time $j$. The first step performs prediction of the state according to the model (without any evidence from data), the second step predicts the value of $y_t$ based only on the model. If the model is good, this prediction should be close to the really measured value of $y_t$.

The difference between the measured and predicted output is called the prediction error $e_t$

$$e_t = y_t - \hat{y}_t$$

and it is used for correction of the estimated state. The procedure performing state estimation for linear model with normal noises is called Kalman filter.

### State estimation with linear model

Here is the subroutine Kalman (with description)

Kalman filter

and here is an example of state estimation

Program and its description

Back to Main

### Kalman filter as a noise filter

Very frequent usage of Kalman filter is for smoothing the measured noisy signal. The model in this case has the form

$$x_t = x_{t-1} + e_{w;t}$$

$$y_t = x_t + e_{v;t}$$

The covariances $r_w$ and $r_v$ determine how smooth the estimate is to be and what is the amplitude of noise to be filtered.

Program and its description

Back to Main