

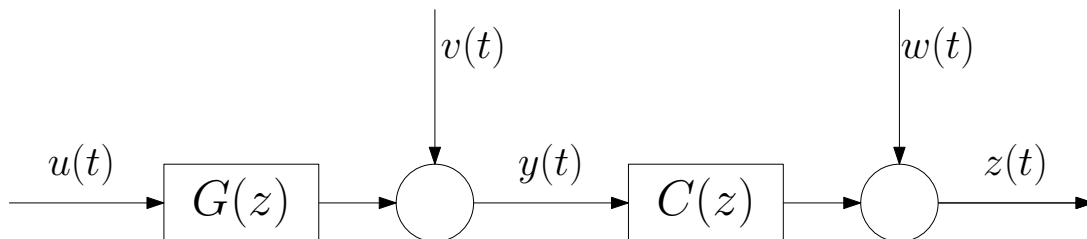
System Identification

Lab session #3 on System Identification

The file `SI_Lab3.mat` contains four data sequences u , y , v , z , relative to the signals $u(t)$, $y(t)$, $v(t)$, $z(t)$, respectively, of a single identification experiment performed on the linear system shown in figure, where $G(z)$ is an unknown transfer function and

$$C(z) = \frac{K}{z - a}$$

with K and a unknown parameters ($K > 0$, $|a| < 1$). All data are sampled with sampling time $T_s = 0.1$ sec.



In every identification procedure, use always the first 500 samples to estimate the models and the remaining 500 samples for the validation of the identified models.

1. By using only the input-output data set $[u \ y]$, identify the best ARX model for the system with input $u(t)$ and output $y(t)$, according to the MDL criterion for order selection. Report the structure of the identified model and the simulation FIT of the model itself.
2. By using the same input-output data set $[u \ y]$ as in point 1, find the most suitable model for the system with input $u(t)$ and output $y(t)$. Test several model structures including ARMAX, OE and BJ models. Motivate the final choice according to the validation techniques studied in the course. Report the chosen model structure, the simulation FIT of the chosen model and its transfer function $G(z)$. According to the model chosen, find a suitable model for the stochastic process $v(t)$.
3. By using all the available data in the most suitable way, find an estimate of the transfer function $G(z)$ as accurate as possible. Report the data set used, the structure of the model, and the poles of $G(z)$. Compare with the model estimated in point 2: which is the best one? Why?
4. By using all the available data in the most suitable way, find an estimate of the parameters K and a of the transfer function $C(z)$. Report the data set used and the structure of the model, motivating the choice. On the basis of the identified model, find a suitable model for the stochastic process $w(t)$.