ID10

ARARMA(X) Identification

10.1 ARARMA(X) MODELS

ARARMA(X) models can be considered as a superset of ARMA(X) and ARAR(X) models in that they describe equation errors as ARMA processes. In the single–input single–output case ARARMAX models are described by the relations

$$e(t) = \delta_{n_\delta} e(t-1) + \ldots + \delta_1 e(t-n_\delta) + w(t) + \gamma_n w(t-1) + \ldots + \gamma_1 w(t-n) \quad (10.1.1)$$

$$y(t) = \alpha_n y(t-1) + \ldots + \alpha_1 y(t-n) + \beta_n u(t-1) + \ldots + \beta_1 u(t-n) + e(t) \quad (10.1.2)$$

where $w(\cdot)$ is a remote white process with null expected value, $\mathrm{E}\,[w(t)] = 0$, independent from the input sequence $u(\cdot)$. The whole model can also be written in the polynomial form

$$q(z^{-1})\, y(t) = p(z^{-1})\, u(t) + \frac{r(z^{-1})}{s(z^{-1})}\, w(t) \quad (10.1.3)$$

where $q(z^{-1})$, $p(z^{-1})$, $r(z^{-1})$ and $s(z^{-1})$ are defined by (6.1.3), (6.1.4), (6.1.5) and (9.1.3). Using a forward notation we can write the model in the forms

$$q(z)\, y(t) = p(z)\, u(t) + \frac{z^{n_\delta} r(z)}{s(z)}\, w(t) \quad (10.1.4)$$

$$y(t) = \frac{p(z)}{q(z)}\, u(t) + \frac{z^{n_\delta} r(z)}{q(z)s(z)}\, w(t) = G(z)\, u(t) + F(z)\, w(t). \quad (10.1.5)$$

where $q(z)$, $p(z)$, $r(z)$ and $s(z)$ are defined by (6.1.8), (6.1.9), (6.1.10) and (9.1.5). ARARMAX models exhibit thus the structure that can be seen in Figure 10.1.1

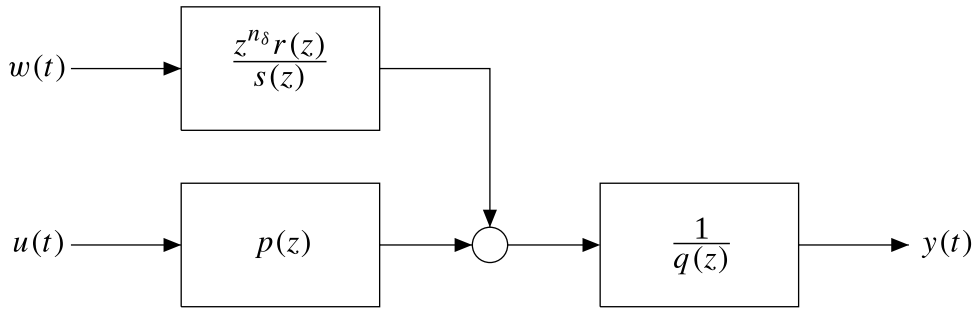

Figure 10.1.1 – Structure of an ARARMAX process

and can be decomposed into deterministic and stochastic parts as shown in Figure 10.1.2.

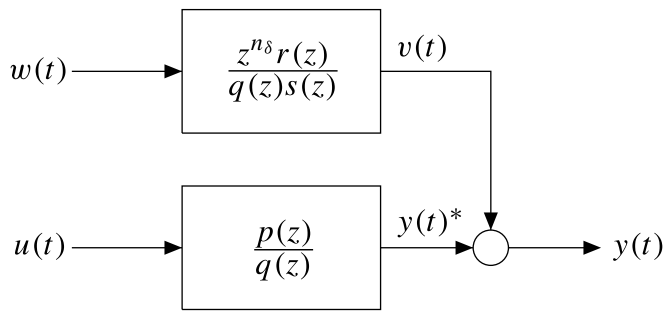

Figure 10.1.2 – Partition of an ARARMAX process