ID7

ARMA Identification

7.1 ARMA MODELS

ARMA models, like ARMAX ones, describe the equation error by means of a MA process but do not consider any observable input; they are thus used, as AR models, to describe time series. In the single output case, ARMA models are described by the difference equation

$$y(t) = \alpha_n y(t-1) + \ldots + \alpha_1 y(t-n) + w(t) + \gamma_n w(t-1) + \ldots + \gamma_1 w(t-n)\,. \quad (7.1.1)$$

They can also be written in the polynomial form

$$q(z^{-1})\, y(t) = r(z^{-1})\, w(t) \quad (7.1.2)$$

where $q(z^{-1})$ and $r(z^{-1})$ are defined by (6.1.3) and (6.1.5). Using a forward notation, (7.1.1) and (7.1.2) become

$$y(t+n) = \alpha_n y(t+n-1) + \ldots + \alpha_1 y(t) + w(t+n) + \gamma_n w(t+n-1) + \ldots + \gamma_1 w(t) \quad (7.1.3)$$

and

$$q(z)\, y(t) = r(z)\, w(t), \quad (7.1.4)$$

where $q(z)$ and $r(z)$ are defined by (6.1.8) and (6.1.10). Evidentiating the transfer function, $F(z)$, between the remote noise $w(t)$ and the observed output, $y(t)$, we can write (7.1.4) in the form

$$y(t) = \frac{r(z)}{q(z)}\, w(t) = F(z)\, w(t) \quad (7.1.5)$$

and interpret an ARMA process as the output of a filter driven by a remote white noise as shown in Figure 7.1.1.

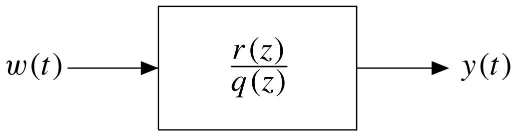

Figure 7.1.1 - Structure of an ARMA process

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