ID4

AR Identification

4.1 AR MODELS

AR models, like ARX ones, belong to the family of equation error models but, differently from ARX models, do not consider any input and are thus used to model time series i.e. ordered sequences of data. AR (AutoRegressive) models are described, in the single output case, by difference equations of the type

$$y(t) = \alpha_n\, y(t-1) + \ \ldots\ + \alpha_1\, y(t-n) + e(t), \tag{4.1.1}$$

where $e(\cdot)$ denotes a stochastic white process with null expected value, $\mathrm{E}\,[e(t)] = 0$, and the integer n defines the order and the memory of the model. The polynomial form (2.1.6) will be

$$q(z^{-1})\; y(t) = e(t) \tag{4.1.2}$$

where

$$q(z^{-1}) = 1 - \alpha_n\, z^{-1} - \ldots - \alpha_1\, z^{-n}. \tag{4.1.3}$$

It is possible to rewrite model (4.1.1) in the significant form

$$y(t) = \frac{1}{q(z^{-1})}\, e(t) = F(z^{-1})\, e(t) \tag{4.1.4}$$

or, using forward notation (2.1.13), in the more common form

$$y(t) = \frac{z^n}{q(z)}\, e(t) = F(z)\, e(t)\,. \tag{4.1.5}$$

We can thus interpret an AR model as a filter driven by a remote (non measurable) white process as shown in Figure 4.1.1.

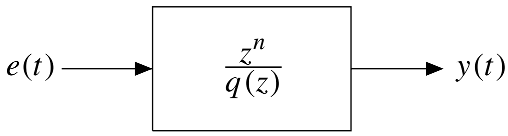

Figure 4.1.1 - Structure of an AR process