

ID3

ARX Identification



3.2 ARX PREDICTORS



Model (3.1.1) is purely dynamic and thus allows, at any time, the estimation of a one-step-ahead prediction of the output on the basis of the observations performed until that moment. Since the equation error is modeled by a white process uncorrelated with the input sequence, the optimal predictor, characterized by whiteness and minimal variance of the prediction error, is given by

$$y(t|t-1) = \alpha_n y(t-1) + \dots + \alpha_1 y(t-n) + \beta_n u(t-1) + \dots + \beta_1 u(t-n). \quad (3.2.1)$$

It is important to note that predictor (3.2.1) does *not* rely on previous predictions (the prediction is a simple regression of observed input and output samples) and is thus free from stability constraints. Predictor (3.2.1) can also be written in the polynomial form

$$y(t|t-1) = (1 - q(z^{-1}))y(t) + p(z^{-1})u(t). \quad (3.2.2)$$

Remark 3.2.1 – The prediction error $\varepsilon(t) = y(t) - y(t|t-1)$ of optimal predictors (3.2.1) and (3.2.2) equals $e(t)$; this error can thus assume high values even when the parameters of the process are exactly known.

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