ID3

ARX Identification

3.20 STRUCTURAL IDENTIFICATION OF MULTIVARIABLE ARX MODELS

The structural identification of multivariable ARX models is the multivariable counterpart of order estimation performed in the MISO case. It is possible to perform this step using the same criteria already described in the scalar case because they are applied in both cases to a scalar cost function.

Since the procedure is independent from the criterion that can be considered, we will make reference to an abstract criterion $CR(\nu) = CR(k_1, \dots, k_m)$ assuming, for an easier exposition, that it exhibits a minimum (like FPE, AIC and MDL).

Structural identification – Consider the sequence of structures $\nu = (k_1, \dots, k_m)$ given by

$$(1, 1, \dots, 1)\ (2, 1, \dots, 1)\ \dots\ (2, 2, \dots, 2)\ (3, 2, \dots, 2)\ \dots \tag{3.20.1}$$

and compute the associated models (3.17.2), predictors (3.17.11) and cost functions $J^*(\theta)$ (3.18.4). Compute now the values of the criterion corresponding to sequence (3.20.1)

$$CR(1, 1, \dots, 1)\ CR(2, 1, \dots, 1)\ \dots\ CR(2, 2, \dots, 2)\ CR(3, 2, \dots, 2)\ \dots \tag{3.20.2}$$

considering the structure that follows the minimum of $CR(\nu)$. If the index increased with respect to the structure corresponding to the minimum is k_i, then take $\nu_i = k_i - 1$ and don't increase any longer this index. Continue to increase remaining indexes according to (3.20.1) until a second minimum, defining a second index, is found and repeat the procedure until all indexes have been determined.

The extension of the procedure to the PPCRE criterion or to the use of whiteness tests on the residuals is described in Example 3.21.