MULTIVARIABLE MODELS : n_u, n_y

$\underline{G}(\Omega, \theta)$ $n_y \times n_u$ TF MATRIX

$\underline{G}_{[i,j]}(\Omega, \theta)$ RATIONAL FORM OF Ω

- NO RELATION BETWEEN COEFFICIENTS OF DIFFERENT TF $\underline{G}_{[i,j]}$

MIMO ≡ PARALLEL MISO SYSTEMS

- OFTEN $\underline{G}_{[i,j]}(\Omega, \theta)$ HAVE THE SAME DENOMINATOR

COMMON DENOMINATOR MODEL

$$\underline{G}(\Omega, \theta) = \frac{B}{A} = \frac{\sum_{r=0}^{n_b} \underline{B}_r \Omega^r}{\sum_{r=0}^{n_a} a_r \Omega^r}$$

POLYNOMIAL MATRIX

- MATRIX-FRACTION MODEL (LEFT MATRIX FRACTION)

$$\underline{G}(\Omega, \theta) = \underline{A}^{-1}(\Omega, \theta)\, \underline{B}(\Omega, \theta) =$$
$$= \left(\sum_{r=0}^{n_a} \underline{A}_r \Omega^r\right)^{-1} \left(\sum_{r=0}^{n_b} \underline{B}_r \Omega^r\right)$$

POLYNOMIAL MATRICES

(RIGHT MATRIX FRACTION)

$$\underline{G} = \underline{B}\, \underline{A}^{-1}$$

MODEL STRUCTURES FOR RATIONAL FORMS

$\Omega_k = s_k, z_k^{-1}$

$z_k = e^{j\omega_k T_s}$

$$\boxed{Y(k) = G(\Omega_k, \theta)\, U(k) + T_G(\Omega_k, \theta) + H(\Omega_k, \theta)\, E(k) + T_H(\Omega_k, \theta) + \delta(\Omega_k)}$$

$\delta(z_k^{-1}) = \phi$ (PERIODIC)

ARX (AUTOREGRESSION WITH EXOGENOUS INPUT)

$$Y(k) = \frac{B(\Omega_k, \theta)}{A(\Omega_k, \theta)} U(k) + \frac{1}{A(\,)} E(k) + \frac{K(\Omega_k, \theta)}{A(\,)}$$

$T_G + T_H$

ONLY THE SUM $I_r + J_r$ CAN BE IDENTIFIED

$C = 1 \quad D = A \quad K = I + J \quad n_k = \max(n_a, n_b) - 1$