FIR

$$y_k = \gamma_0 \mu(u_{1c}) + \gamma_1 \mu(u_{1c-1}) + \dots + \gamma_{s-1} \mu(u_{1c-(s-1)}) + z_{1c} =$$

$$\boxed{\mu(u) = a_1 \varphi_1(u) + \dots + a_m \varphi_m(u)}$$

$$= \gamma_0 \left[a_1 \varphi_1(u_{1c}) + a_2 \varphi_2(u_{1c}) + \dots + a_m \varphi_m(u_{1c}) \right]$$
$$+ \gamma_1 \left[a_1 \varphi_1(u_{1c-1}) + a_2 \varphi_2(u_{1c-1}) + \dots + a_m \varphi_m(u_{1c-m}) \right]$$
$$+ \dots$$
$$+ \gamma_{s-1} \left[a_1 \varphi_1(u_{1c-(s-1)}) + \dots + a_m \varphi_m(u_{1c-(s-1)}) \right] + z_{1c} =$$

$$= \underbrace{\begin{bmatrix} \gamma_0 \cdot a_1 \\ \gamma_0 \cdot a_2 \\ \vdots \\ \gamma_0 \cdot a_m \\ \gamma_1 a_1 \\ \gamma_1 a_m \\ \gamma_{s-1} a_1 \\ \gamma_{s-1} a_m \end{bmatrix}^T}_{\theta} \cdot \underbrace{\begin{bmatrix} \varphi_1(u_{1c}) \\ \varphi_m(u_k) \\ \varphi_1(u_{k-1}) \\ \varphi_2(u_{k-1}) \\ \varphi_1(u_{k-s-1}) \\ \varphi_m(u_{k-(s-1)}) \end{bmatrix}}_{\varphi} + z_{1c} = \theta^T \phi_k + z_{1c}$$

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \vdots \\ y_N \end{bmatrix} = Y_N \qquad \Phi_N = \begin{bmatrix} \phi_1^T \\ \phi_2^T \\ \vdots \\ \phi_N^T \end{bmatrix} \quad \begin{matrix} N \\ = \end{matrix} \quad \overbrace{\begin{bmatrix} \quad \\ \quad \\ \quad \\ \quad \end{bmatrix}}^{s \cdot m}$$

$$\boxed{\hat{\theta} = \left(\Phi_N^T \Phi_N \right)^{-1} \Phi_N^T Y_N}$$