

$$\begin{aligned}
P &= \begin{bmatrix} 1 & \chi_1(t_1) & \dots & \chi_{m_a}(t_1) & \varphi(|\chi(t_1) - \mathbf{c}_1|) & \dots & \varphi(|\chi(t_1) - \mathbf{c}_{m_b}|) \\ & & & \vdots & & & \\ 1 & \chi_1(t_N) & \dots & \chi_{m_a}(t_N) & \varphi(|\chi(t_N) - \mathbf{c}_1|) & \dots & \varphi(|\chi(t_N) - \mathbf{c}_{m_b}|) \end{bmatrix} \\
Q &= \begin{bmatrix} 0 & \underbrace{0 \dots 0}_{m_a} & \ddot{\varphi}(|\chi(t_1) - \mathbf{c}_1|) + (d-1) \frac{\dot{\varphi}(|\chi(t_1) - \mathbf{c}_1|)}{|\chi(t_1) - \mathbf{c}_1|} \dots \ddot{\varphi}(|\chi(t_1) - \mathbf{c}_{m_b}|) + (d-1) \frac{\dot{\varphi}(|\chi(t_1) - \mathbf{c}_{m_b}|)}{|\chi(t_1) - \mathbf{c}_{m_b}|} \\ & & \vdots \\ 0 & \underbrace{0 \dots 0}_{m_a} & \ddot{\varphi}(|\chi(t_N) - \mathbf{c}_1|) + (d-1) \frac{\dot{\varphi}(|\chi(t_N) - \mathbf{c}_1|)}{|\chi(t_N) - \mathbf{c}_1|} \dots \ddot{\varphi}(|\chi(t_N) - \mathbf{c}_{m_b}|) + (d-1) \frac{\dot{\varphi}(|\chi(t_N) - \mathbf{c}_{m_b}|)}{|\chi(t_N) - \mathbf{c}_{m_b}|} \end{bmatrix} \\
w_k &= (a_0, a_1, \dots, a_{m_a}, b_1, \dots, b_{m_b})^T, \\
\mathbf{c}_i &= \chi(m_a + ci \bmod N), \quad c \in \mathbb{Z}, \\
y_k &= (\chi_k(t_1 + p), \dots, \chi_k(t_N + p))^T \\
\left(P^T P + \frac{\mu}{N} Q^T Q \right) w_k &= P^T y_k
\end{aligned}$$