$$J = X^T_{1*(1+n*dim)} * Q_{(1+n*dim)*(1+n*dim)} * X_{(1+n*dim)*1} + q^T_{1*(1+n*dim)} * X_{(1+n*dim)*1}$$

$$s.t. \quad L_{((4+2n)*dim)*1} \leq A_{((4+2n)*dim)*(1+n*dim)} X_{1+n*dim} \leq U_{((4+2n)*dim)*1}$$

$$J = T * Q_T * T + \sum_{i=0}^{n-1} (p_i - p_{ir})^T * r * (p_i - p_{ir})$$

$$X = [T, p_0, \ldots, p_{n-1}]^T = [T, p]^T_{(1+n*dim)*1}$$

$$R = \begin{bmatrix} r & & \\ & \ddots & \\ & & r \end{bmatrix}_{(n*dim)*(n*dim)}$$

$$Q = \begin{bmatrix} Q_T & \\ & R \end{bmatrix}_{(1+n*dim)*(1+n*dim)}$$

$$P_r = [p_{0r}, \ldots, p_{(n-1)r}]^T_{(n*dim)*1}$$

$$q = [0, -R * P_r]^T_{(1+n*dim)*1}$$

$$B_i(t)_{dim*dim}$$

$$B(t) = [B_0(t), B_1(t), \ldots, B_{n-1}(t)]_{dim*(n*dim)}$$

$$Aq_0 = [0, B(0)]_{dim*(1+n*dim)}$$

$$(Aq_0 * X)_{dim*1} = q_0$$

$$Aq_1 = [0, B(1)]_{dim*(1+n*dim)}$$

$$(Aq_1 * X)_{dim*1} = q_1$$

$$M = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ -1 & 1 & 0 & \cdots & 0 \\ 0 & -1 & 1 & \cdots & 0 \\ \vdots & & \ddots & & \vdots \\ 0 & \cdots & \cdots & -1 & 1 \end{bmatrix}_{(1+n*dim)*(1+n*dim)}$$

$$\dot{B_i}(t)_{dim*dim}$$

$$\dot{B(t)} = [\dot{B_0}(t), \dot{B_1}(t), \ldots, \dot{B_{n-1}}(t)]_{dim*(n*dim)}$$

$$Aqdq(t)_{dim*(1+n*dim)} = [0, \dot{B(t)}]_{dim*(1+n*dim)} * M_{(1+n*dim)*(1+n*dim)}$$

$$\dot{r(t)}_{dim*1} = Aqdq(t) * X$$

$$\dot{r(0)} = 0$$

$$\dot{r(1)} = 0$$

$$Aqdq_0 * X = 0$$

$$Aqdq_1 * X = 0$$

$$Aq = [Aq_0; Aq_1; Aqdq_0; Aqdq_1]_{(4*dim)*(1+n*dim)}$$

$$Lq = Uq = [q_0, q_1, 0, 0]^T_{(4*dim)*1}$$

$$dqmin = [\dot{q_{min}}, \ldots, \dot{q_{min}}]^T_{(n*dim)*1}$$

$$dqmax = [\dot{q_{max}}, \ldots, \dot{q_{max}}]^T_{(n*dim)*1}$$

$$dB = [\dot{B(t_0)}; \dot{B(t_1)}; \ldots; \dot{B(t_{n-1})}]_{(n*dim)*(n*dim)}$$

$$AiqL = [-dqmin, dB]_{(n*dim)*(1+n*dim)}$$

$$AiqU = [-dqmax, dB]_{(n*dim)*(1+n*dim)}$$

$$A = [Aq; AiqL; AiqU]_{((4+2n)*dim)*(1+n*dim)}$$

$$L = [Lq; 0; +inf]_{((4+2n)*dim)*1}$$

$$U = [Uq; -inf; 0]_{((4+2n)*dim)*1}$$