$$Q_i^F = \begin{bmatrix} F_i^P \\ \bar{s}_i^{PT} B_i^T \cdot F_i^P \end{bmatrix} \qquad Q_i^T = \begin{bmatrix} 0 \\ 0 \\ T_i \end{bmatrix}$$

$$Q = \begin{bmatrix} F_i^P \\ \bar{s}_i^{P\,T} B_i^T \; F_i^P + T_i \end{bmatrix} = \begin{bmatrix} -\Phi_{r_i}^{(k)T} \lambda^{(k)} \\ -\Phi_{\varphi_i}^{(k)T} \lambda^{(k)} \end{bmatrix}$$

$$\boxed{F_i^P} = -\Phi_{r_i}^{(k)T} \; \lambda^{(k)}$$

$$\boxed{T_i} = - \bar{s}_i^{PT} B_i^T F_i^P - \Phi_{\varphi_i}^{(k)T} \lambda^{(k)}$$

$$= + \underline{\bar{s}_i^{PT} B_i^T \; \Phi_{r_i}^{(k)T}} \lambda^{(k)} - \Phi_{\varphi_i}^{(k)T} \lambda^{(k)}$$

$$= \left[\left(\Phi_{r_i}^{(k)} B_i \bar{s}_i^P\right)^T - \Phi_{\varphi_i}^{(k)T} \right] \lambda^{(k)}$$

$$= \underline{\left\{ \Phi_{r_i}^{(k)} B_i \bar{s}_i^P - \Phi_{\varphi_i}^{(k)} \right\}^T \lambda^{(k)}}$$