



Fig. R1: An application scenario of RIS-assisted MIMO radar.

The expressions of $\mathbf{D}_{t,p}$, $\mathbf{d}_{t,p}$, and $c_{t,p}$ in (11b) can be easily calculated based on (7) and (10).

$$\mathbf{D}_{t,p} = \sum_{i=1, i \neq t}^T \sigma^2 \tilde{\mathcal{F}}_i^H(\phi_i) \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \tilde{\mathcal{F}}_i(\phi_i) + \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \tilde{\mathcal{F}}_{t,q}^H(\phi_t) \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \tilde{\mathcal{F}}_{t,q}(\phi_t), \quad (\text{R1a})$$

$$\mathbf{d}_{t,p}^H = -2 \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \tilde{\mathcal{F}}_t(\phi_t), \quad (\text{R1b})$$

$$c_{t,p} = \sigma_z^2 \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p}. \quad (\text{R1c})$$

Substituting (15) into (10), the expressions of $\mathbf{F}_{t,p}$, $\mathbf{G}_{t,p}$, $\mathbf{L}_{t,p}$, $\mathbf{f}_{t,p}$, $\mathbf{g}_{t,p}$, and $\hat{c}_{t,p}$ can be calculated as

$$\mathbf{F}_{t,p} = \sum_{i=1, i \neq t}^T \sigma^2 \mathbf{C}_i^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_i + \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \mathbf{C}_{t,q}^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_{t,q}, \quad (\text{R2a})$$

$$\mathbf{G}_{t,p} = \sum_{i=1, i \neq t}^T \sigma^2 \mathbf{E}_i^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{E}_i + \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \mathbf{E}_{t,q}^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{E}_{t,q}, \quad (\text{R2b})$$

$$\mathbf{L}_{t,p} = 2 \sum_{i=1, i \neq t}^T \sigma^2 \mathbf{E}_i^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_i + 2 \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \mathbf{E}_{t,q}^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_{t,q}, \quad (\text{R2c})$$

$$\mathbf{f}_{t,p}^H = 2 \sum_{i=1, i \neq t}^T \sigma^2 \mathbf{a}_i^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_i + 2 \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \mathbf{a}_{t,q}^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_{t,q} - 2 \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{C}_t, \quad (\text{R2d})$$

$$\mathbf{g}_{t,p}^H = 2 \sum_{i=1, i \neq t}^T \sigma^2 \mathbf{a}_i^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{E}_i + 2 \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \mathbf{a}_{t,q}^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{E}_{t,q} - 2 \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{E}_t, \quad (\text{R2e})$$

$$\hat{c}_{t,p} = \sum_{i=1, i \neq t}^T \sigma^2 \mathbf{a}_i^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{a}_i + \sum_{t=1}^T \sum_{q=1}^Q \varsigma^2 \mathbf{a}_{t,q}^H \mathbf{M}_{t,p}^{-1} \mathbf{s}_{t,p} \mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{a}_{t,q} - 2 \Re\{\mathbf{s}_{t,p}^H \mathbf{M}_{t,p}^{-1} \mathbf{a}_t\} + c_{t,p}. \quad (\text{R2f})$$