Step 1: Source transmission

- Source S_i, $i \in \{A,B\}$ maps its data symbol $\mathbf{d}_i = \left[\mathbf{d}_i^b; \mathbf{d}_i^s\right]$ into a $(N_b + N_s)$-bit superposition modulation symbol

$$s_i = \mathscr{A}^i\left(\left[\mathbf{d}_i^b; \mathbf{d}_i^s\right]\right), \tag{1}$$

- S_A, S_B simultaneously transmit their signals to the relay and unintended destinations (Fig. **??**).

- Relay receives

$$x = h_{AR}\mathscr{A}^A\left(\left[\mathbf{d}_A^b; \mathbf{d}_A^s\right]\right) + h_{BR}\mathscr{A}^B\left(\left[\mathbf{d}_B^b; \mathbf{d}_B^s\right]\right) + w_R \tag{2}$$

  and decodes $\left[\mathbf{d}_A^s; \mathbf{d}_B^s; f(\mathbf{d}_A^b, \mathbf{d}_B^b)\right]$, where f is a hierarchical WNC function [**?**].

- D_j receives

$$z_j = h_{ij}\mathscr{A}^i\left(\left[\mathbf{d}_i^b; \mathbf{d}_i^s\right]\right) + w_j, \tag{3}$$

  where $i, j \in \{A,B\}$, $i \neq j$ and stores the signal for further processing.

Step 2: Relay broadcast

- Relay sends $N_R = 2N_s + N_b$-bit modulation symbol to both destinations:

$$s_R = \mathscr{A}^R\left(\left[\mathbf{d}_A^s; \mathbf{d}_B^s; f(\mathbf{d}_A^b, \mathbf{d}_B^b)\right]\right). \tag{4}$$

- D_j ($i, j \in \{A,B\}$, $i \neq j$) decodes:
  - $\left[\mathbf{d}_A^s; \mathbf{d}_B^s; f(\mathbf{d}_A^b, \mathbf{d}_B^b)\right]$ (from the relay signal (4))
  - $\mathbf{d}_i^b$ (from the stored signal z_j (3), after interference cancellation (IC) of known $\mathbf{d}_i^s$)
  - $\mathbf{d}_j^b$ (from $\mathbf{d}_i^b$ and $f(\mathbf{d}_A^b, \mathbf{d}_B^b)$, using a standard WNC decoding [**?**])

- D_j merges $\mathbf{d}_j^b$ with $\mathbf{d}_j^s$ to obtain the desired $\left[\mathbf{d}_j^b; \mathbf{d}_j^s\right]$.

Table 1: SC-based relaying scheme in uncoded WBN

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