Antenna Switching Sequence Design for Channel Sounding in a Fast Time-varying Channel

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Motivation & Introduction

- Intelligent Transport System
- V2V MIMO Channel sounding/modeling
- Large number of antennas -> reduced Doppler estimation range
- Goal: enlarge the Doppler estimation range

Algorithm and Simulation

Simulated annealing

### Problem Setup

- Introduce the spatio-temporal ambiguity function
- Formulate the sequence design problem as an optimization problem

\[
\begin{align*}
\min_{\mathbf{S}_{T} \in \mathcal{C}} & f_{\nu}(\mathbf{S}_{T}) \\
\text{s.t.} & |\mathbf{S}_{T}|_{m,T} = (|\mathbf{S}_{T}|_{m,T-1} - 1)t_{1} + (t-1)M_{T}t_{2},
\end{align*}
\]

\[
f_{\nu}(\mathbf{S}_{T}) = \iiint_{D} \left| X_{T}(\varphi_{T}, \varphi'_{T}, \Delta \nu) \right|^p \, d\varphi_{T} \, d\varphi'_{T} \, d\Delta \nu,
\]

\[D = \{ (\varphi_{T}, \varphi'_{T}, \Delta \nu) \mid \varphi_{T}, \varphi'_{T} \in (\pi, \pi) \text{ & } \Delta \nu \in [0, \nu_{\text{max}}] \}.
\]

Discussion & Future Work

- Integrate the switching scheme into a super-resolution parameter extraction algorithm
- Validation of the algorithm and the scheme in vehicle-to-vehicle and mm-wave MIMO channel measurements

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