**System Features**

- **Goals**
  - To deploy two or more antennas at handsets to dynamically reconfigure the antenna beam
- **Requirement:** Low-power dissipation
- **Benefits:** Antenna gain and diversity gain

**Space-Time Processing**

- Signal impairments in wireless communications are due to intersymbol interference (ISI) and cochannel interference (CCI).
- Temporal signal processing reduces ISI using an equalizer or a rake receiver.
- Spatial signal processing reduces CCI using a smart antenna.
CDMA System with Smart Antenna

- Rake receiver in a handset processes the dual antenna signals.

Channel Coding \(\rightarrow\) Spreading \(\rightarrow\) Modulation RF

Channel Decoding \(\leftarrow\) Rake Receiver \(\leftarrow\) RF Demodulation

Channel Model

- Channel model with dual antennas

\[ S(t) \]

\[ e^{-j\phi_01} Z^{-\tau_1} \text{Path loss Rayleigh fading} \]

\[ e^{-j\phi_11} Z^{-\tau_2} \text{Path loss Rayleigh fading} \]

\[ e^{-j\phi_02} \text{Path loss Rayleigh fading} \]

\[ e^{-j\phi_21} \text{Path loss Rayleigh fading} \]

\[ e^{-j\phi_22} \text{Path loss Rayleigh fading} \]

AWGN1 \(\rightarrow\) \[ r_1(t) \]

AWGN2 \(\rightarrow\) \[ r_2(t) \]
Rake Receiver Design

- Combining or selecting method can be used for the des-sprea-ding signals.
- Proposed rake receiver block

Performance of Smart Antenna

- Simulation setup with Cadence SPW

- FER (frame error rate) with smart antenna