Adaptive Array Processing for Ad Hoc Networks

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MSR

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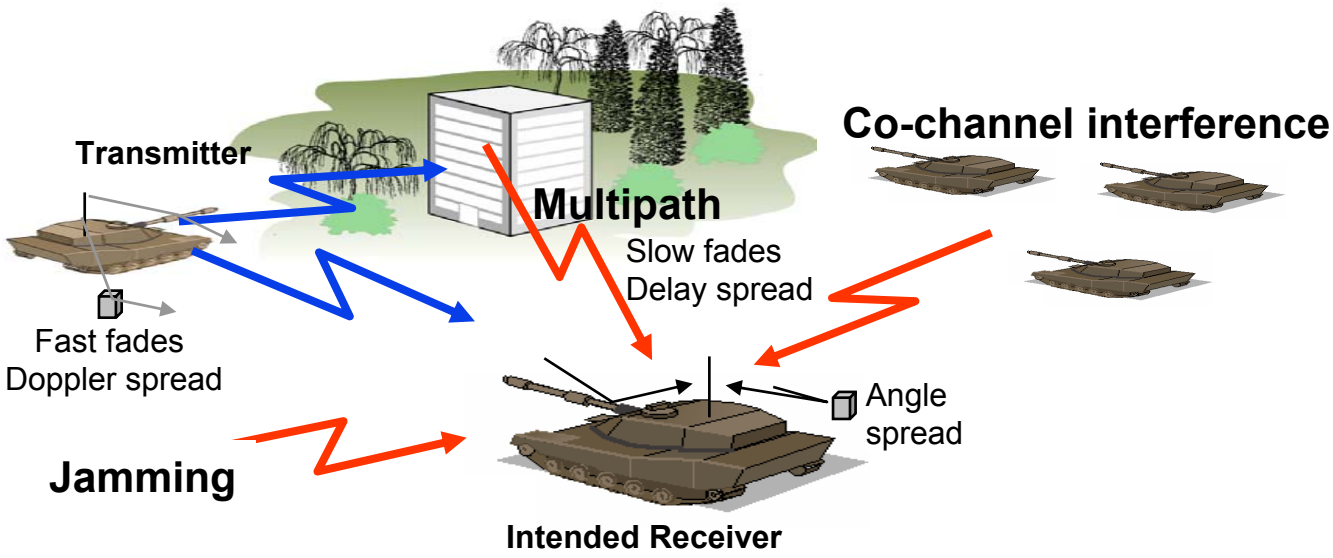
Problem

- As demands on military mobile ad hoc networks (MANETs) increase, more advanced techniques are required to combat the effects of multipath fading, hostile jammers, and co-channel interference.
- Adaptive array processing techniques improve performance, but current algorithms are not well suited for military environments.
- New array processing algorithms are needed that are robust, computationally inexpensive, and tailored for ad hoc networks.

Background



- **Mitigation of these impairments is required to improve system performance.**
- **Spatial processing has been under-utilized in addressing these impairments.**

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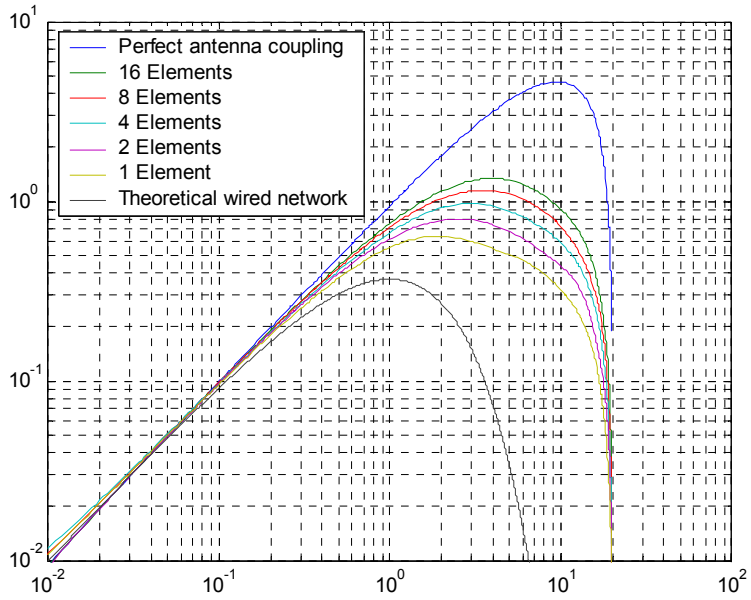
Objective

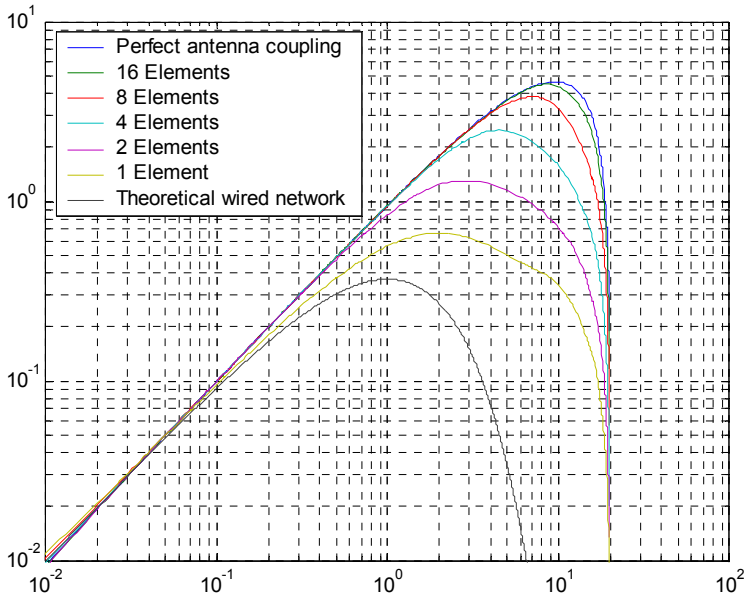
- Use computer simulations to determine statistical performance of adaptive arrays in peer-to-peer networks
- Determine lower bounds on degrees of freedom required for significant performance improvement
- Develop blind/semi-blind receive and transmit space-time adaptive processing (STAP) algorithms

Activities

- Designed a system-level simulation for evaluating adaptive array systems in mobile ad hoc networks
- Investigating transmit adaptive array processing techniques
- Evaluating integration of adaptive array processing methods in OFDM systems

Highlight





Beam steering only **Beam+null steering**

System throughput in a mobile ad hoc network with various antenna configurations

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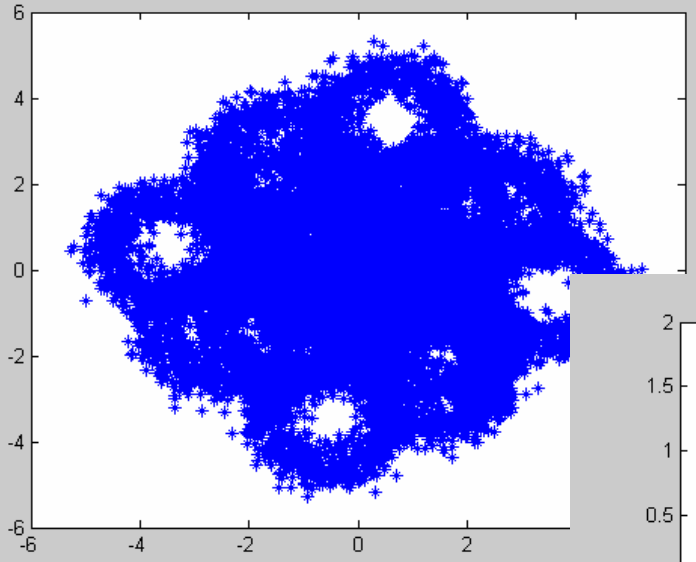
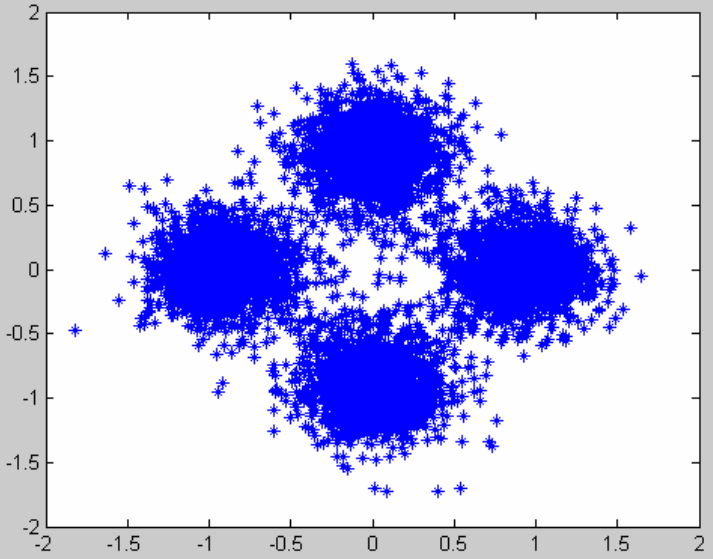
Highlight/Demonstration



QPSK Constellation
Pre-Adaptation

QPSK Constellation
Post-Adaptation



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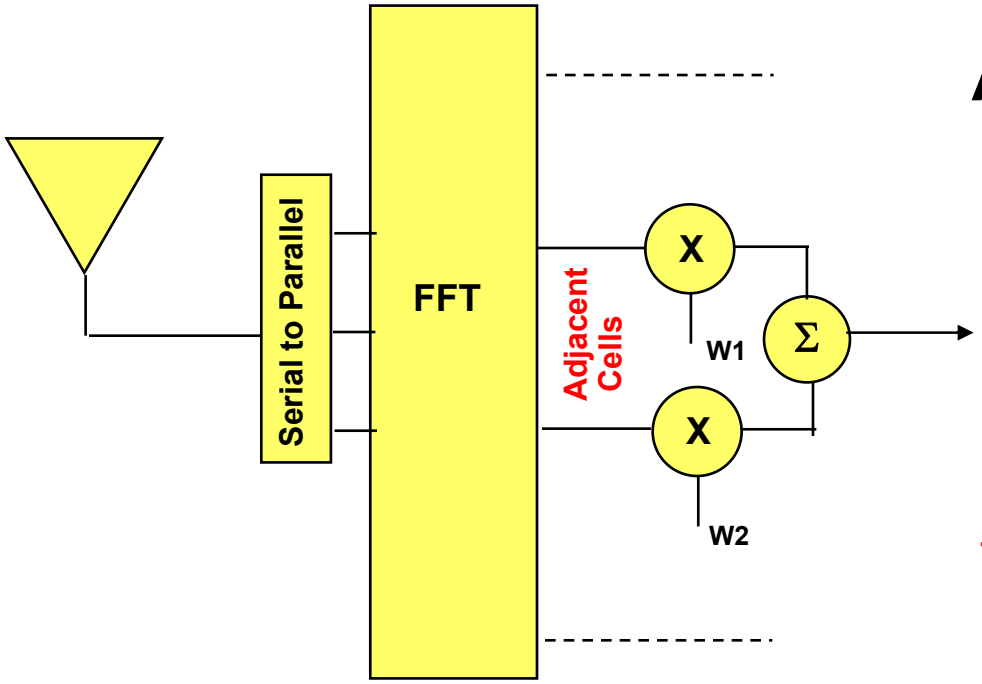
Impacts

- Array processing techniques being developed will increase range and data rates, while reducing packet collisions, vulnerability to friendly and hostile interference, and probability of interception and detection.
- The results will provide improvements to communications systems that are primarily ad hoc, such as DARPA Future Combat Systems (FCS) communications.

Future Plans



Alternate Adaptive Array Architectures for OFMD

For a three-bin FFT, the weight pairs are

1 and 2
2 and 3
3 and 1

which produces 3 outputs with 6 weights.

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