A Literature Survey on the Energy Efficiency of MIMO Systems

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Introduction:

Multiple-Input Multiple-Output (MIMO) technology is being incorporated into wireless systems as it enables increased spectral efficiency through spatial multiplexing and increased signal quality through spatial diversity. A MIMO channel can be decomposed into a number, ‘L’, of parallel independent channels and by multiplexing independent data streams onto these channels. This increases the data rate by a factor of ‘L’. This gain is called multiplexing gain. In this way MIMO technology is used to increase spectral efficiency. MIMO technology is also used to increase the quality of signal by multi-stream beamforming. Here the channels gains are coherently combined to obtain a high diversity gain leading to improved signal quality. Thus a wireless system may use MIMO technology to obtain multiplexing gain, diversity gain or both.

In this project, we intend to conduct a literature survey on the energy efficiency of these two methods in order to summarize an optimal trade-off between the two gains in terms of power consumption. A study on the energy consumption for transmission and by the processing circuitry of various MIMO with non-cooperative, half-cooperative and cooperative realizations in wireless sensor networks when both diversity and multiplexing gain are considered lead to the conclusion that both multiplexing and diversity gain must be exploited in order to have optimal energy efficiency [1]. Also an optimal constellation size can improve MIMO systems in terms of energy efficiency and cooperative MIMO systems are superior to non-cooperative MIMO systems over certain transmission distance ranges [2]. Several other studies on the energy efficiency of MIMO systems have been conducted [3;4;5].

We will try to break down these various studies in terms of the different systems, their energy consumption for transmission and by the circuit, and the diversity gain and/or multiplexing gain achieved. By comparing these results the cost of increased diversity gain or increased multiplexing gain or both on energy consumption will be summarized.

Schedule:

The project will carried out in the following stages.

1) Background: Further reading on MIMO systems and the trade –off between diversity and multiplexing gain.

2) Literature survey and comparison: A detailed study of the focus papers to break down the systems in terms of energy consumption, multiplexing and diversity gain and compare them.
3) Further study: If time permits a generalized model for the energy consumption of MIMO systems will be formed, considering both the transmission and circuit energy consumption, tested with measurements taken with an IEEE 802.11n standard WAP.

References:

Focus Papers:


Supporting Papers:
