

INFORMATION ON DOCTORAL DISSERTATION

Title of the thesis: **Study on solutions to analyze and evaluate the performance of next-generation radio communication systems using Energy Harvesting Techniques.**

Specified field of study: Telecommunications Engineering

Code of specialty: 9.52.02.08

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Name of the research supervisors:

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2. Dr. Truong Trung Kien

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THE SCIENTIFIC CONTRIBUTIONS

The contribution of the thesis has three folds listed as follows:

- Model #1: We have proposed energy harvesting based MIMO relay networks where the communication between the source and the destination is done via the help of a relay. The source and the destination are equipped with multi-antennas but the relay is with single antenna. For performance analysis, we have suggested a new analysis approach to derive the closed form expression for the system outage probability over Rayleigh fading, which are both valid for low and high SNRs. The new analysis approach provides a better approximation of the system outage probability as compared with the conventional approach, which is only suitable for high SNR regime. Numerical results via Monte-Carlo simulation confirmed the correctness of the suggested analysis approach and studied the system characteristics.
- Model #2: An energy harvesting two-way relay network with power beacon has been proposed. All nodes are powered by the power beacon. The system performance in terms of outage probability over Nakagami- m has been studied for the first time. The simulation results based on MATLAB confirmed the

accuracy of the analysis results and indicated that the location of the source and the relay node greatly influenced the system performance.

- Model #3: An energy harvesting based underlay relay networks has been proposed and investigated over Rayleigh fading channels. Both advantages offered from energy harvesting and cognitive radio has been exploited for relay networks making the proposed communication protocols can be applied in practice.

ON PRACTICAL APPLICABILITY AND FURTHER STUDIES

The research results including analytical methods and proposed models can be applied as follows:

- Novel derivation approaches have been proposed to evaluate the system performance of the proposed energy harvesting based networks. The obtained analysis results are valid not only at high SNRs but also low SNRs. In addition, the derivation approach can be applied for any wireless fading channels under consideration.
- Three energy harvesting based communication networks have been proposed, which takes advantages from advanced technologies at physical layers such as: half/full duplexing, MIMO and cognitive radio. Such proposed communication networks can be applied for wireless sensor networks or IoT applications.
- The effect of channel and system parameter settings has been studied show us the way to optimize system performance of energy harvesting based communication networks.

Supervisors

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