VIETNAM NATIONAL UNIVERSITY
HO CHI MINH CITY
Ho Chi Minh City University of Technology

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INFORMATION OF THE DISSERTATION

PhD candidate: **LE TY KHANH**

Title: **DESIGNS OF OPTIMIZATION ALGORITHMS FOR SPECTRAL AND ENERGY EFFICIENCY MAXIMIZATION IN MULTI-USER MIMO SYSTEMS**

Major: **Telecommunications Engineering**

Major code: **62.52.02.08**

Scientific advisor:

1. **Dr. Nguyen Minh Hoang**
2. **Assoc. Prof. Ha Hoang Kha**

Institution: **Ho Chi Minh City University of Technology – Vietnam National University-Ho Chi Minh City.**

Dissertation's objectives

The main objective of the thesis is to investigate advanced communication system models using MIMO, cognitive radio, and multi-cell technologies to increase frequency spectrum utilization. Specially, the thesis investigates the communication models of multi-user MIMO cognitive radio networks, multi-cell multi-user MIMO wireless networks, and cell-free massive MIMO systems. Then, the thesis proposes optimization approaches to design signal processing blocks at transceivers to maximize the system performance including spectral efficiency (SE) and efficiency energy (EE) subject to various constraints at the physical layer. The proposed models and solutions are verified and evaluated through numerical simulations on MATLAB.

Contributions of the dissertation

The thesis has the following main contributions:

- Proposing an optimization algorithm to design optimal signal processing blocks at transmitters and receivers based on interference alignment (IA) techniques in cognitive radio communication networks. The optimally designed IA method in the thesis allows secondary users to achieve maximum bit rates in the secondary network while causing negligible interference to the primary user.
- Proposing an optimization algorithm to design pre-processing blocks at the transmitters to maximize EE in multi-cell multi-user communication networks. The proposed optimization method is an iterative optimization algorithm based on the difference of convex functions and the Dinkelbach optimization method. The obtained optimal precoders allow the system to achieve better EE than previous methods using optimal SE

- Proposing an approach using a deep neural network (DNN) to design optimal transmit power allocation coefficients and receive filters to maximize proportional fairness SE in the uplink channels of a cell-free massive MIMO system. The method of designing optimal receive filters and optimal transmit power allocation based on DNN has noticeably lower computational time and complexity than the traditional iterative optimization methods while SE is not significantly reduced. The results of this study show the feasibility of applying deep learning (DL) for signal processing in wireless communication networks.

Scientific Advisor **PhD Candidate**

Dr. Nguyen Minh Hoang **Assoc. Prof. Ha Hoang Kha** **Le Ty Khanh**