Notice for the PhD Viva-Voce Examination

Mr Delson T R (Registration Number: 1447202), PhD Scholar at the School of Engineering and Technology, CHRIST (Deemed to be University), Bangalore will defend his PhD thesis at the public viva-voce examination on Friday, 11 April 2025 at 10.30 am in the CDI Conference Room, III Floor, Block V, Bangalore Kengeri Campus, Bengaluru - 560074, Karnataka, India.

Title of the Thesis	:	**Study, Analysis and Optimization of Uplink Spectral Efficiency for Massive MIMO 5G Communication**
Discipline	:	**Electronics and Communication Engineering**
External Examiner - I	:	**Dr P Palanisamy** Professor Electronics and Communication Engineering NIT Trichy, Tanjore Main Road Tamil Nadu – 620015
External Examiner - II	:	**Dr S Akhila** Professor Department of Electronics and Communication Engineering B.M.S. College of Engineering Bengaluru, Karnataka - 560019
Supervisor	:	**Dr Iven Jose** Professor (Former) Department of Electronics and Communication Engineering School of Engineering and Technology CHRIST (Deemed to be University) Bengaluru, Karnataka - 560074

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 02 April 2025

ABSTRACT

This research aims to study, analyze, and optimize the spectral efficiency of 5G wireless communication systems using Massive MIMO technology. This standard aim for the spectral efficiency of 15 bps/Hz in uplink and 30 bps/Hz in downlink scenarios. However, in 5G standards and specifications, the theoretical upper limit of achievable spectral efficiency is not bounded, leaving room for open research. Hence, this research is thus motivated to choose the maximization of this parameter for the 5G Massive MIMO simulation network. Initially, the research focuses on an in-depth study of 5G standards, specifications and test scenarios. Subsequently, the constraint parameters influencing spectral efficiency are analyzed and optimized for improved results. The research also carried out hardware experimental studies related to 5G internet connectivity, modulation schemes, and spectral efficiency using the OAI (Open Air Interface) framework are conducted at the 5G Testbed lab and software-defined radio (SDR) hardware demonstration for the modulation classification of live video transfer using machine learning neural network algorithms.

The research work focused on the spectral efficiency parameter improvement by considering the uplink scenario in the 5G Massive MIMO network with different receiver combining schemes, such as MMSE, ZF, and MRC. The spectral efficiency in this research work achieved is 3.5 times higher than the value proposed in the LTE release 17 of 5G Specifications. This work identifies the right balancing of constraint parameters with optimization algorithms which improves the spectral efficiency metric. Hence, this research study significantly contributes the newer methods which improve spectral efficiency in future LTE releases in 5G and beyond.

Keywords: *5G, Massive MIMO, Spectral efficiency, receiver combining schemes, optimization methods*

Publications:
1. **Delson T R** and Iven Jose, "Performance Analysis on LTE based Transceiver Design with Different Modulation Schemes", International *Journal of Current Engineering and Scientific Research (IJCESR)*, Vol-4, Issue-5, 2017.
2. **Delson T R** and Iven Jose, "Analysis and Optimization of Uplink Spectral Efficiency in Massive MIMO", *Indonesian Journal of Electrical Engineering and Computer Science*, vol 28, no. 2, pp. 830-839, 2022.
3. **Delson T R** and Iven Jose, "Study on 5G Massive MIMO Technology Key Parameters for Spectral Efficiency Improvement Including SINR Mapping on Rural Area Test Case." In *2022 IEEE 3rd Global Conference for Advancement in Technology (GCAT)*, pp. 1-6. IEEE, 2022.
4. **Delson T R** and Iven Jose, "A survey on 5G standards, specifications and massive MIMO testbed including transceiver design models using QAM modulation schemes." In *2019 International conference on data science and communication (IconDSC)*, pp. 1-7. IEEE, 2019