Notice for the PhD Viva Voce Examination

Mr Shashi Kumar D (Registration Number: 1560081), 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 Saturday, 06 May 2023 at 10.00 am in the CDI Conference Room, III Floor, Block V, Bangalore Kengeri Campus, Bengaluru 560074.

Title of the Thesis	**:**	**Investigations on the Design, Performance and Effect of Feed Mechanisms, Defected Ground Structures and Metamaterials for Optimized Microstrip Antenna Array**
Discipline	**:**	**Electronics and Communication Engineering**
External Examiner (Outside Karnataka)	**:**	**Dr V Subramanian** Professor Microwave Laboratory Department of Physics IIT - Chennai Chennai - 600036 Tamil Nadu
External Examiner (Within Karnataka)	**:**	**Dr Chandrakanta Kumar** Scientist and Head Electromagnetic Section U R Rao Satellite Centre Bengaluru - 560017 Karnataka
Supervisor	**:**	**Dr Suganthi S** Professor Department of Electronics and Communication Engineering School of Engineering and Technology CHRIST (Deemed to be University) Bengaluru – 560074 Karnataka

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

Place: Bengaluru
Date: 20 April 2023

ABSTRACT

Microstrip antenna exhibiting low-profile features such as flexible, lightweight and lowproduction cost attracts majority of communication industries working the lower part of the microwave spectrum ranging from 1 GHz to 6 GHz. Also, the microwave integrated circuit technology enables the integration of feed systems and other microwave integrated circuits on the same substrate where the antenna is printed. However, single antenna topologies feature a number of drawbacks, including weak gain, poor directivity, narrow bandwidth and limited coverage being low in profile. In the perspective of miniaturization, developments in wireless communication have had a significant impact on antenna or array design based on the gain, bandwidth and directivity requirements for specific wireless applications. As a result, usage of single antenna is not considered appropriate for diversity reception, long-distance communication, signal-to-interference aswell as signal-to-noise ratiomaximization, and direction of arrival determination, interference rejection, and high power applications. A high-gain broadband antenna or array may be the good choice for outdoor line-of-sight access points to increase signal strength and coverage range. To meet these requirements the antenna designers either can use conventional antennas or rely on miniaturized antennas. When antenna arrays are built using such small antennas to enhance the above said parameters, suitable and compact feed networks are required to fit within the given space of the overall transmitter-receiver geometry.

This research work addresses the challenges faced by antenna researchers in miniaturization, maintenance of gain-bandwidth and high-directivity narrow-beam radiation of microstrip antenna arrays, through an investigation made on the design, new mathematical modelling of feedmechanisms for arrays, their influence on 1D and 2D uniform and non-uniform arrays, and the performance enhancement by amalgamating proposed arrays with defected ground structures and metasurfaces. The mathematicalmodelling developed in this research work for array feed networks have been verified with different case studies, and found versatile for multi-element arrays. The single microstrip antenna, and the proposed arrays have been designed at 2.45 GHz suitable for the ISM (Industrial, Scientific andMedical) band. Overall size reduction, enhanced gain, bandwidth, much focused radiation with narrower beam width have been achieved with the proposed antenna arrays. They were designed and simulated using Ansys HFSS v-18.2, fabricated using photolithography method, characterized by measurements done in an anechoic chamber using vector network analyzer. The validation of the proposed research was carried out through analyticalmathematical modelling, comparison of simulated and measured results as well as results reported in literature by other similar researchers. Outcomes of this research work at various stages have been published as articles in international journals and conferences, which are publicly available in the respective sites for anyone to access.

Keywords*: Array, defected ground structure, feed networks, microstrip antenna, mathematical modelling for feed, metamaterial, metasurface, narrow beam, uniform andnon-uniform array*

Publications:

1. **Shashi Kumar D** and S. Suganthi, "Antenna array miniaturization using a defectedground structure," *Trends in Sciences*, Vol.19, no.13, pp. 1-9, 2022. (Scopus indexed)
2. **Shashi Kumar D** and S. Suganthi, "Novel hybrid metamaterial to improve the performance of a beamforming antenna," *J. Phys.: Conf. Ser.*, Vol. 1921, no. 012020, pp. 1-9,May2021.(Scopus indexed)
3. **Shashi Kumar D** and Suganthi S., "A novel antenna array with Dolph Chebyshev Excitation and DNG Hybrid Metasurface for Next Generation Communication Equipment," *International Journal ofMicrowave and optical technology*, Vol.16, No. 2, pp. 175-183, Jan 2021. (Scopus indexed)
4. **Shashi Kumar D** and S. Suganthi, "AMiniaturized Antenna Array for Direct Airto-Ground Communication of Aircrafts," *J. Phys.: Conf. Ser.*, Vol. 1706, no. 012084, pp. 1-11, Dec 2020. (Scopus indexed)