



## Phase Shifters for Radar and Wireless Communication Systems

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### ABSTRACT

Phase shifters are commonly employed for beam scanning in radar systems for surveillance, tracking and navigation. They also find application in wireless communication systems such as 5G/6G networks to improve signal quality and coverage. Depending on the specific application, different types of phase shifters are required in practical systems.

In this talk, work done on design and development of different types of phase shifters in the Centre for Applied Research in Electronics, IIT Delhi over past four decades will be presented. First the design and development of high-power ferrite phase shifters for practical phase array radar will be presented. Specifically, two configurations, namely, twin-toroid phase shifter and dual mode phase shifter with integrated radiating elements will be presented.

Next, design and development of medium power pin diode-based phase shifters will be described. For wireless communication systems, the above configurations of phase shifters are not suitable due to their bigger size and weight. Development of MEMS based phase shifters will next be described. Several novel configurations with high reliability, small size and light weight will be presented. Finally, phase shifters based on carbon nano-tubes, LTCC-ferrite integration and Phase change materials will be briefly described.

### BIO



**Dr. Shibban Koul** received Master of Technology degree in microwave engineering in 1979 and PhD degree in the same field in 1983 from the Indian Institute of Technology Delhi, in India. He is currently an Honorary Professor at the Indian Institute of Technology, Delhi. His research interests include RF MEMS, high frequency wireless communication, microwave engineering, microwave passive and active circuits, device modelling, millimetre and sub-millimetre wave IC design, body area networks, flexible and wearable electronics, medical applications of sub-terahertz waves, EMI/EMC suppression techniques and reconfigurable microwave circuits including miniaturized antennas.

He has successfully Completed 38 major sponsored projects, 52 consultancy projects and 61 technology development projects. He has authored/co-authored 635 research Papers, 26 state-of-the art books, 5 book chapters and 2 e-books. He holds 26 patents, 6 copyrights and one Trademark. He has guided 30 Ph.D. theses and more than 120 master's theses.

Shiban is a Life Fellow of IEEE and Fellow of INAE and IETE. He is the Chief Editor of IETE Journal of Research. From 2012 to 2014, he served as Distinguished Microwave Lecturer (DML) for IEEE MTT-S. Currently he is Distinguished Lecturer (DL) for IEEE EMC-S. He is recipient of numerous awards including IEEE MTT Society Distinguished Educator Award -2014, Lifetime Achievement Award-2023 from the IETE, India and Lifetime Achievement Award-2024 from the Broadcast Society of India.