National Conference on Computational Intelligence, Engineering, Science and Technology (NCCIEST – 2018)
30th December, 2018, New Delhi, India.

CERTIFICATE NO : NCCIEST /2018/ C1218911

A STUDY OF SUPERCONDUCTING CIRCUIT AND INTRIGUING MARVELS WITH REGARDS TO THE SYSTEM

NISHA

Research Scholar, Ph.D. in Physics, Dr. A.P.J. Abdul Kalam University, Indore, M.P.

ABSTRACT

During the last ten years, superconducting circuits have passed from being interesting physical devices to becoming contenders for near-future useful and scalable quantum information processing (QIP). Advanced quantum simulation experiments have been shown with up to nine qubits, while a demonstration of Quantum Supremacy with fifty qubits is anticipated in just a few years. Quantum Supremacy means that the quantum system can no longer be simulated by the most powerful classical supercomputers. Integrated classical-quantum computing systems are already emerging that can be used for software development and experimentation, even via web interfaces. Therefore, the time is ripe for describing some of the recent development of superconducting devices, systems and applications. As such, the discussion of superconducting qubits and circuits is limited to devices that are proven useful for current or near future applications. Consequently, the centre of interest is the practical applications of QIP, such as computation and simulation in Physics and Chemistry. The near-term goal is to operate a physical quantum device that a classical computer cannot simulate, therefore demonstrating Quantum Supremacy. For QIP to be of interest one often requests “killer applications”, outperforming classical supercomputers on real-world applications like factorisation and code breaking. However, this is not a realistic way to look upon the power of QIP. During the last seventy years, classical information processing has progressed via continuous development and improvement of more or less efficient algorithms to solve specific tasks, in tune with the development of increasingly powerful hardware. The same will certainly apply also to QIP, the really useful applications arriving along the way. There is, in fact, already a clear short-term QIP perspective, recognising the importance of quantum technologies (QT) and quantum engineering for driving the present and near-future

development. This is necessary for developing large scale devices to achieve the long-term goals of useful quantum computing. To this end, investigations of quantum device physics have been essential for the present efforts to scale up of multi-qubit platforms. The work on improving coherence has demonstrated that qubits are extremely sensitive to a variety of noise sources. The requirement of making measurements without destroying the coherence has led to the development of a range of quantum limited superconducting amplifiers. As a result, advanced quantum sensors and quantum measurement may give rise to a new quantum technology: ”a qubit at the tip of a scanning probe”, greatly enhancing the sensitivity of magnetic measurements.

Keywords: , Superconducting Circuits, Scalable Quantum Information Processing (QIP).