Paper ID: 79712
student

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems (1)

Author: Mr. Priyank Dubey
University of Luxembourg, Luxembourg , priyankdubey@ext.uni.lu

Prof. Andreas Makoto Hein
University of Luxembourg, Luxembourg , andreas.hein@uni.lu

QUANTUM COMPUTING FOR SPACE: EXPLORING QUANTUM CIRCUITS ON PROGRAMMABLE NANOPHOTONIC CHIPS

Abstract

Quantum circuits are the fundamental computing model of quantum computing. It consists of a sequence of quantum gates that act on a set of qubits to perform a specific computation. For the implementation of quantum circuits, programmable nanophotonic chips provide a promising foundation with a large number of qubits. The current study explores the possible potential of quantum circuits implemented on programmable nanophotonic chips for space technology. In the recent findings, it has been demonstrated that quantum circuits have several advantages over classical circuits, such as exponential speedups, multiple parallel computations, and compact size. Apart from this, nanophotonic chips also offer a number of advantages over traditional chips. They provide high-speed data transfer as light travels faster than electrons. Photons require less energy to transmit data than electrons, so nanophotonic chips consume less power than conventional chips. The bandwidth of nanophotonic chips is greater than that of traditional chips, so they can transfer more data simultaneously. They can be easily scaled to smaller sizes with higher densities and are more robust to extreme temperatures and radiation than classical chips. The focus of the current study is on how quantum circuits could revolutionize space technology by providing faster and more efficient computations for a variety of space-related applications. All the in-depth analysis is carried out while taking currently available state-of-the-art technologies into consideration.