Chapter 4
Quantum-Inspired or Neuromorphic Discrete-Event Computing Paradigms for Future Ubiquitous Systems

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ABSTRACT

Foundations of quantum-inspired discrete-event architectures constitute an emerging and transformative paradigm in the modelling, simulation, and design of complex, dynamic, and stochastic systems, particularly in the context of large-scale distributed networks, Internet of Things (IoT) ecosystems, cyber-physical systems, cloud and edge computing, service-oriented architectures, and high-performance computing environments, where traditional discrete-event simulation (DES) approaches face challenges related to scalability, uncertainty, combinatorial complexity, and real-time decision-making; quantum-inspired methodologies draw conceptual and algorithmic insights from quantum mechanics, quantum computing principles, and quantum information theory, including superposition, entanglement, probabilistic amplitudes, and parallelism, to enhance the capability of DES frameworks to represent, process, and optimize highly complex event-driven interactions across heterogeneous devices, services, and computing layers.

1. INTRODUCTION

Foundations of quantum-inspired discrete-event architectures constitute an emerging and transformative paradigm in the modelling, simulation, and design of complex, dynamic, and stochastic systems, particularly in the context of large-scale distributed networks, Internet of Things (IoT) ecosystems, cyber-physical systems, cloud and edge computing, service-oriented architectures, and high-performance computing environments, where traditional discrete-event simulation (DES) approaches face challenges related to scalability, uncertainty, combinatorial complexity, and real-time decision-making; quantum-inspired methodologies draw conceptual and algorithmic insights from quantum mechanics, quantum computing principles, and quantum information theory, including superposition, entanglement, probabilistic amplitudes, and parallelism, to enhance the capability of DES frameworks to represent, process, and optimize highly complex event-driven interactions across heterogeneous devices, services, and computing layers. These architectures integrate the