Distribution and Segmentation Methods of Graph States Based on Quantum Networks

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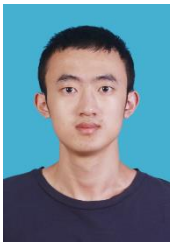
***Abstract*—In recent years, quantum communication and quantum computing have become strategic technologies of great importance to countries around the world, with profound implications for individuals, businesses, and even nations. Among these, graph states are a very important class of multi-particle entangled states, playing a crucial role in fields such as quantum secret sharing, measurement-based quantum computing, and quantum metrology. However, the distribution of graph states faces the following challenges: existing quantum communication networks designed for single-qubit transmission cannot effectively accomplish graph state distribution tasks, and current methods for graph state distribution lack consideration of node resources, making it difficult to complete graph state distribution in some cases.**

We conduct research on cross-node graph states distribution methods in quantum communication networks under limited resource constraints. To address the issue that current quantum communication networks cannot handle graph states and other multi-particle entangled states, a graph state distribution method is proposed. This method combines local operations and classical communication to meet the distribution requirements for graph states, which are multi-particle entangled states. Additionally, to solve the problem of limited quantum resources at individual nodes, we proposed a graph states segmentation method. This method divides a complete graph state into subgraphs for distribution and subsequently integrates them, enabling graph state distribution services in a broader range of resource scenarios..

***Keyword*—Quantum Communication, Graph States, Entanglement Distribution, Quantum Network, Graph Theory.**



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His current research area is quantum communication networks, and he has published two related papers as a co-author in this area, *Xin Sun, Tianzhu Hu, **Haomin Chen**, Tianze Zhu, Xiaofeng Jiang, "High-fidelity Entanglement Distribution for Quantum Communication Network", The 43rd Chinese Control Conference*, *Tianzhu Hu, Xiaofeng Jiang, Tianze Zhu, Xin Sun, **Haomin Chen**, Jian Yang, "A Reliable Routing Method for Remote Entanglement Distribution under Limited Resources", in Proceedings of 2024 26th International Conference on Advanced Communications Technology, ICACT, 2024*; Apply for two patents as a co-inventor, CN202311173809X and CN202310750256.3; Apply for a patent as the first inventor and is currently in the patent publicity period, CN202411350910.2.