

量子光学

基于隐形传态的量子稳定子码容错编码门构造方法研究

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摘要: 量子容错编码门可有效减少量子态与环境噪声的耦合作用,是量子计算和量子通信的研究热点之一。文章基于隐形传态提出一种稳定子码的量子容错编码门的构造方法。量子隐形传态构造法是通过隐形传递得到的编码态执行假想的编码门,然后将该假想门往前移,使得编码门构造的困难减小到仅容错制备一个特殊辅助态即可。以编码Hadamard门,编码相位门为例详述了该方法的实现过程,并通过数值分析验证了隐形传态构造法的正确性。最后,计算各编码门的构造开销,并与文献[16]中的编码门构造方法相比较,结果表明隐形传态法下,编码门的物理量子门减少了60*n个,辅助块和各减少了5个;编码门的物理量子门减少了16*n个,辅助块减少了1个,减少了2个。

关键词: 量子物理 容错编码门 稳定子码 隐形传态 开销

Construction method of quantum fault-tolerant encoded gates of the stabilizer code based on teleportation

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Abstract: Quantum fault-tolerant encoded gates could reduce the inevitable coupling of the physical qubits to the noisy environment, and it has been one of the hot topics in quantum communication and quantum computation. In this paper, we propose a novel constructing quantum fault-tolerant encoded gates method based on teleportation for the general stabilizer code. We first make use of the quantum teleportation to get the teleported code and apply the imaginary encoded gate to the teleported code, then move it forward, so the difficulty to construct encoded gate could be reduced to prepare a special ancillary state. We select the encoded Hadamard gate and phase gate as examples to explain the constructing procedure, and the numerical analysis verify that the method is valid. The results show that under the teleportation method, encoded gate decreases 60*n physical quantum gates, 5 encoded block and 5 ancilla block ; encoded gate decreases 16*n physical quantum gates, 1 encoded block and 2 ancilla block when compared with the overhead in [16].

Keywords: quantum physics fault-tolerant encoded gate stabilizer code teleportation overhead

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