Bipartite and multipartite entanglement in entangled graphs

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Abstract

In this study, we have obtained a parametric relationship for the entanglement measurement between each pair of qubits for graphs with more than four qubits. We have also calculated the value of entanglement in five-qubit entangled graphs. Analysis of our results shows that the total of 1024 five-qubit entangled graphs, based on the maximum entanglement between each pair of qubits, are categorized into 31 groups and if we consider the number of graph edges and degrees of vertices then these states are classified in 40 classes. Also, based on the numerical results obtained from multipartite entanglement measures such as generalized concurrence, global measurements, and Meyer-Wallach measurements, we show that 1024 graphs of the five-qubit system are in 24, 32 and 23 categories, respectively. We conclude that the maximum amount of entanglement belongs to the cycle graph and the minimum value belongs to the one-edge graph. While the maximum amount of entanglement between each pair of qubits is in the one-edge graph and the minimum value is in the complete graph.

Keywords: Entanglement, Entangled graph, Generalized concurrence measure, Global entanglement measure, Meyer-Wallach measure

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