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Analysis of Quantum Annealing Architectures: A Spin Glass Perspective

Although quantum annealing has shown promising results, it still struggles to outperform classical optimization algorithms. One of the reasons for this is that the qubit connectivities in superconducting circuits, which are one of the most promising platforms for quantum annealing, are not complex enough. This work focuses on the analysis of different architectures for quantum annealing. On one hand we will study those used in existing superconducting devices, on the other hand we will study several types of small-world and random regular networks that are better-understood but less-fabricable. Our goal is to study, from the perspective of spin glasses and statistical mechanics, the hardness of the problems that can be embedded in these architectures, and how this hardness scales as the architectures grow. This will be a useful consideration to design future quantum annealing architectures.

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