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Title: A quantum annealer with fully programmable all-to-all coupling via Floquet engineering

Abstract: Quantum annealing is an interesting approach to heuristically solving difficult combinatorial optimization problems. However, the connectivity limitations in current devices lead to an exponential degradation of performance on general problems. We propose an architecture for a quantum annealer that achieves full connectivity and full programmability while using a number of physical resources only linear in the number of spins. We do so by application of carefully engineered periodic modulations of oscillator-based qubits, resulting in a Floquet Hamiltonian in which all the interactions are tunable; this flexibility comes at a cost of the coupling strengths between spins being smaller than they would be had the spins been directly coupled. Our proposal is well-suited to implementation with superconducting circuits, and we give analytical and numerical evidence that fully-connected, fully-programmable quantum annealers with 1000 qubits could be constructed with Josephson parametric oscillators having coherence times of 500 microseconds, and other system-parameter values that are routinely achieved with current technology. Our approach could also be relevant beyond quantum annealing, since it readily extends to bosonic quantum simulators and would allow the study of models with arbitrary connectivity between lattice sites. [1] T. Onodera*, E. Ng*, P.L. McMahon. *npj Quantum Information* **6**, 48 (2020). https://doi.org/10.1038/s41534-020-0279-z