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**Title: Ferromagnetically shifting the power of pausing.**

**Abstract:** We study the interplay between quantum annealing parameters in embedded problems, providing both deeper insights into the physics of these devices and pragmatic recommendations to improve performance on optimization problems. We choose as our test case the class of degree-bounded minimum spanning tree problems. Through runs on a D-Wave quantum annealer, we demonstrate that pausing in a specific time window in the anneal provides improvement in the probability of success and in the time-to-solution for these problems. The time window is consistent across problem instances, and its location is within the region suggested by prior theory and seen in previous results on native problems. An approach to enable gauge transformations for problems with the qubit coupling strength  $J$  in an asymmetric range is presented and shown to significantly improve performance. We also confirm that the optimal pause location exhibits a shift with the magnitude of the ferromagnetic coupling,  $|J_F|$ , between physical qubits representing the same logical one. We extend the theoretical picture for pausing and thermalization in quantum annealing to the embedded case. This picture, along with perturbation theory analysis, and exact numerical results on small problems, confirms that the effective pause region moves earlier in the anneal as  $|J_F|$  increases. It also suggests why pausing, while still providing significant benefit, has a less pronounced effect on embedded problems.