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Ground State Spin Logic JAMES WHITFIELD, University of Vienna, MAURO FACCIN, JACOB BIAMONTE, Institute for Scientific Interchange —
Designing and optimizing cost functions and energy landscapes is a problem encountered in many fields of science and engineering. These landscapes and cost functions can be embedded and annealed in experimentally controllable spin Hamiltonians. Using an approach based on group theory and symmetries, we examine the embedding of Boolean logic gates into the ground-state subspace of such spin systems. We describe parameterized families of diagonal Hamiltonians and symmetry operations which preserve the ground-state subspace encoding the truth tables of Boolean formulas. The ground-state embeddings of adder circuits are used to illustrate how gates are combined and simplified using symmetry. Our work is relevant for experimental demonstrations of ground-state embeddings found in both classical optimization as well as adiabatic quantum optimization.

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