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Numerical implementation of “rigorous renormalization group” for ground states and low-energy excited states of 1d Hamiltonians BRENDEN ROBERTS, THOMAS VIDICK, OLEXEI MOTRUNICH, California Institute of Technology — The “rigorous renormalization group” (RRG) is a recently-developed algorithm (Landau, Vazirani, Vidick, Nat. Phys. 11, 2015) for obtaining MPS ansatz approximations to the ground spaces and low-lying excited spectra of local Hamiltonians. The technique is related to constructions used recently to tighten the bound in the proof of the area law in one dimension (Arad, Kitaev, Landau, Vazirani, Proc. 4th ITCS, 2013). The RRG algorithm does not rely on the iterated optimization of local degrees of freedom; rather, it operates in a tree-like manner on subspaces of Hilbert space to increase overlap with the low-energy eigenspace of a Hamiltonian. Because of this, the algorithm handles in a natural way both ground state degeneracy and approximation of low-energy excited spectra. We describe the background and implementation of the algorithm and exhibit results comparing our implementation with DMRG for various systems of interest.

Brenden Roberts
California Institute of Technology

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