DMRG

Aaron Sander

March 2020

1 Purpose

- This program is used for initial learning of tensor network methods to be used in my bachelor thesis.
- It is an implementation of Matrix Product States (MPS) and Density Matrix Renormalization Group (DMRG) for finding the ground state of an arbitrary Hamiltonian.

2 Steps

1. Initialize a Hamiltonian tensor for N particles
2. Decompose it with the MPS method
3. Apply variational method to determine energy value
4. Minimize energy one matrix at a time while holding others constant
5. Apply DMRG? (TBD)

3 Description

We choose an arbitrary N-particle 1D Hamiltonian with nearest-neighbor spin interaction.

$$H = \sum_{i}^{N} \sigma_i^z \sigma_{i+1}^z + g\sigma_i^x$$

with j^{th} Pauli matrix of the i^{th} lattice position $\sigma_i^j \in M(\mathbb{C}, 2x2)$ and parameter g.