Hamiltonian Forging of a Thermofield Double

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We address the variational preparation of Gibbs states as the ground state of a suitably engineered Hamiltonian acting on the doubled Hilbert space. The construction is exact for quadratic fermionic Hamiltonians and gives excellent approximations up to fairly high quartic deformations. We provide a variational circuit whose optimization returns the unitary diagonalizing operator, thus giving access to the whole spectrum. The problem naturally implements the entanglement forging ansatz, allowing the computation of Thermofield Doubles with a higher number of qubits than in competing frameworks.

References

[1]   Daniel Faílde, Juan Santos-Suárez, David A. Herrera-Martí and Javier Mas. https://arxiv.org/abs/2311.10566
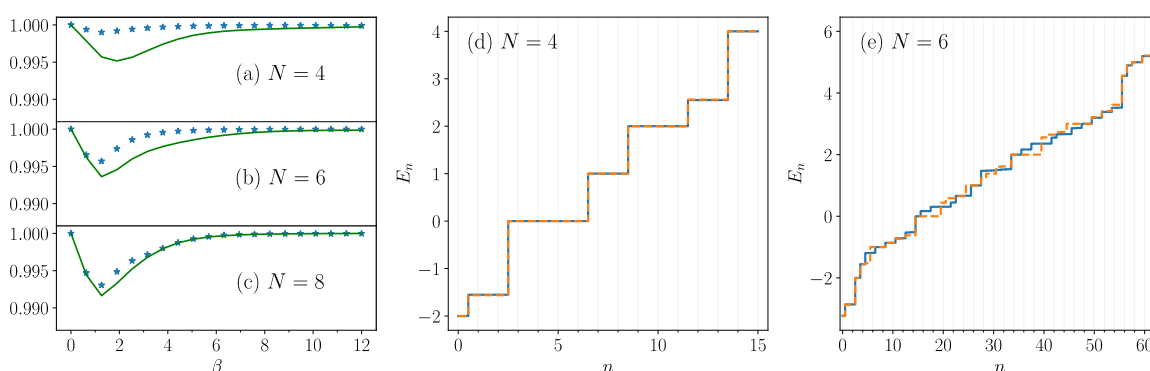
Figures

Figure 1:
Simulation for the Hubbard model at t = U = 1. Left, overlap of the engineered variational ground state with the searched Thermofield Double. Right, full spectrum at values of N=4, 6 in orange, versus exact diagonalization, in blue.