Abstract

Bethe Ansatz is widely used to describe thermodynamic properties of certain one-dimensional quantum many-body models. One such model is the gapless spin-1/2 anisotropic Heisenberg chain with periodic boundary conditions. This thesis presents a numerical method of solving Bethe equations of this model which is based on exact diagonalization, transfer matrix, and polynomial-fitting. To find these solutions can be quite challenging. The solution will contain the set of roots to the Bethe equation that are self-conjugate. They will arrange in the structures symmetric around real axis which are called strings. These strings are clusters of overturned spins and represent bound states. Proposed method not only finds solutions to the Bethe equations but also obtains roots of transfer matrix eigenvalues which are able to identify the string structures in the state. The findings show that the transfer matrix is able to describe all eigenstates of the system. The complete results of string solutions and roots of transfer matrix eigenvalues are provided for each eigenstate of short chains.