High-field low-temperature properties of distorted diamond chain
Oleg Derzhko\textsuperscript{a}, Johannes Richter\textsuperscript{b}, and Olesia Krupnitska\textsuperscript{c}
\textsuperscript{a}Institute for Condensed Matter Physics NASU, Lviv, 79011, Ukraine
\textsuperscript{b}Universit"at Magdeburg, P.O. Box 4120, 39016 Magdeburg, Germany
\textsuperscript{c}Department for Theoretical Physics, Ivan Franko National University of Lviv, Lviv, 79005, Ukraine, E–mail: krupnitskaolesya@gmail.com

In the present paper we consider the spin-1/2 antiferromagnetic Heisenberg model with the Hamiltonian

\[ H = \sum_{(ij)} J_{ij} \mathbf{s}_i \cdot \mathbf{s}_j - \hbar S^z, \quad S^z = \sum_i S_i^z \]

on a distorted diamond chain, see below. The ideal diamond chain is obtained by setting \( J_1 = J_3, J_m = 0, \) and \( J_2 > 2J_1. \) The high-field low-temperature thermodynamics of the ideal diamond chain can be obtained within the frames of the independent localized magnon picture [1]. We extend the independent localized magnon description for small deviations from ideal geometry. The obtained (approximate) analytical results for the high-field magnetization curve at low temperatures are in a reasonable agreement with exact diagonalization data for finite systems of 18 sites. We also discuss the high-field magnetization curve for the azurite \( \text{Cu}_3(\text{CO}_3)_2(\text{OH})_2, \) which can be regarded as a model compound of distorted diamond spin chain [2] with the set of exchange constants \( J_1 = 15.51 \text{ K}, J_2 = 33 \text{ K}, J_3 = 6.93 \text{ K}, J_m = 4.62 \text{ K} \) [3].