

Fast algorithm to embed bigger subproblem to D-Wave machine

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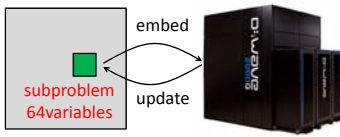
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1. Digest

Embedding algorithm to obtain high accurate solution for large problem is proposed

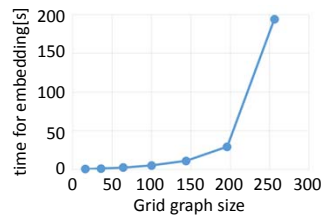
2. Conventional method

1. qbsolv
Iterative solver for large problem
Extract subproblem optimization



Complete graph embedding is used
⇒ size of subproblem become small

2. heuristic embedding
Grid graph to D-Wave2000Q

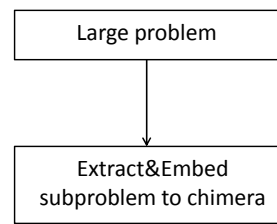


Computational time is too long to use for iterative solver

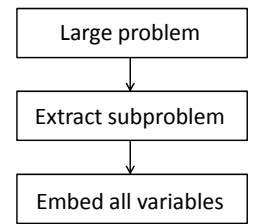
We expect fast algorithm to embed bigger subproblem improves the solution accuracy

3. Proposed method

< proposed method >
select part of variables which can be easily embedded



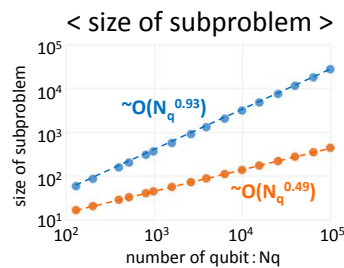
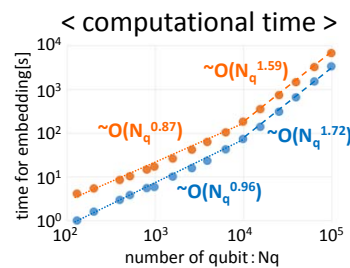
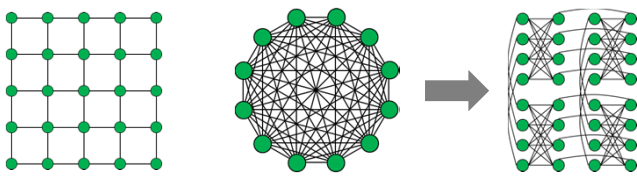
< conventional method >
subproblem is embedded after subproblem is extracted



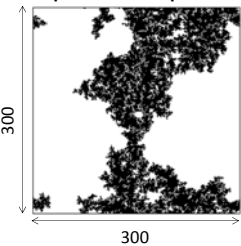
Extracting and embedding subproblem is simultaneously implemented

4. Result 1

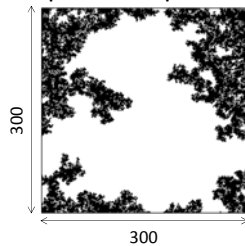
We evaluated the computational time of our algorithm
grid graph 300 x 300 variables, complete graph 1,000 variables, chimera graph 10²~10⁵ qubits



< example of subproblem1 >



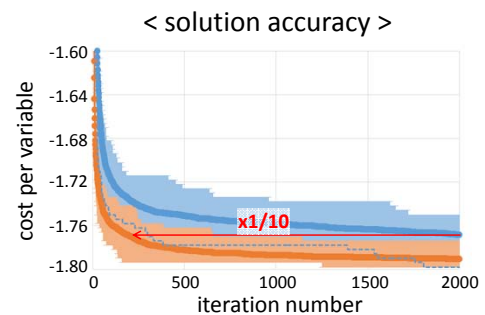
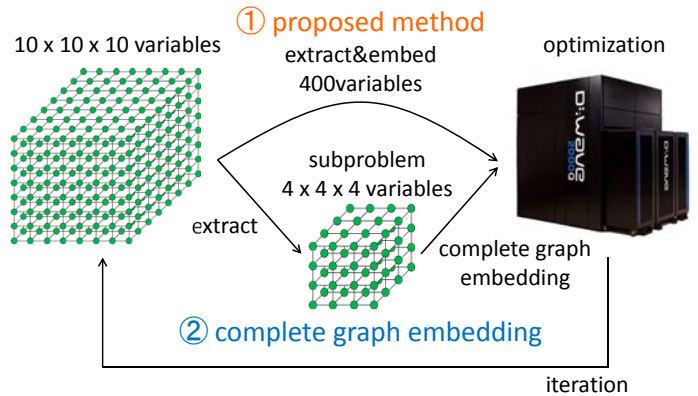
< example of subproblem2 >



the computational time is of order $N_q^{1.7}$

5. Result 2

We solved the 3D $\pm J$ Ising model by our method and compared with the complete graph embedding



Accurate solution can be obtained with much smaller number of iteration

