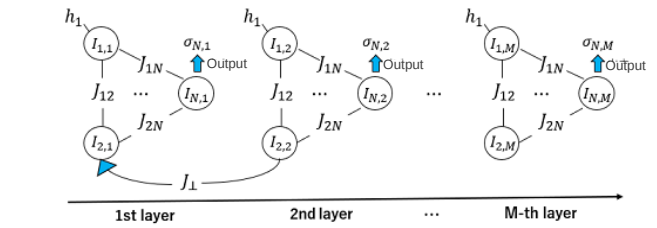
Tohoku Univ. Technology

Simplification and speed up of optimization problem solving method

Quantum Monte Carlo method based on stochastic computing for solving combinatorial optimization problems on digital computer



State equation : $I_{i,k}(t+1) = I_{i,k}(t) + h_i + J_{ij}m_{j,k}(t) + J_{\perp}m_{i,k-1}(t-\alpha) + rnd$ (1)

$$Itanh_{i,k}(t+1) = \begin{cases} I_0 - 1 & if \quad Itanh_{i,k}(t) + I_{i,k}(t+1) \geq I_0 \\ -I_0 & if \quad Itanh_{i,k}(t) + I_{i,k}(t+1) < -I_0 \\ Itanh_{i,k}(t) + I_{i,k}(t+1) & otherwise \end{cases} \quad (2)$$

Spin : $\sigma_{i,k}(t+1) = \begin{cases} 1 & if \quad Itanh_{i,k}(t+1) \geq 0 \\ -1 & otherwise \end{cases}$ (3)

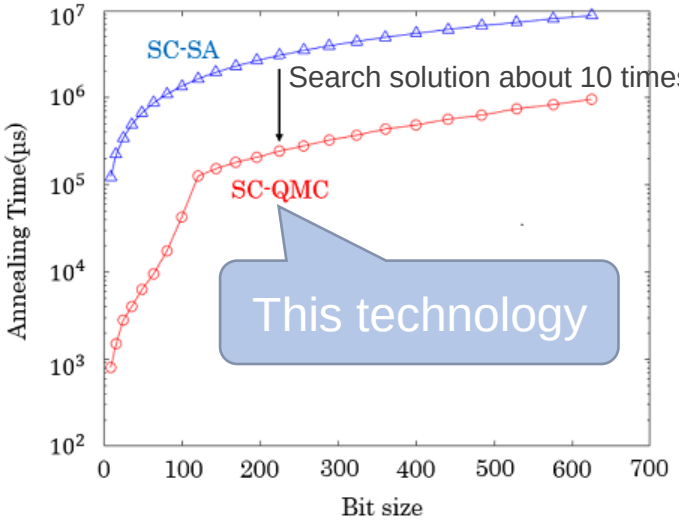
Composition of QMC method based on stochastic computing

Overview

The combinatorial optimization problem has been attracting attention in recent years as a method for solving different social problems. The quantum annealing method (QA) is expected to be a promising way to find solutions to these problems at high speed. However, the current QA is not suitable for solving large scale problem due to the implementation scale limitation and the necessity to prepare a dedicated system. The stochastic simulated annealing method (SC-SA) currently under research, which is a computing method based on probabilistic information, has no restriction due to its computation on a classical system, and it is power-saving. However, the speed is slow and it has difficulty for installation as the scale becomes larger.

Therefore, this technology has been developed to solve optimization problem at high speed with low power consumption for less than two orders of magnitude compared to QA, with less implementation scale limitation and lower cost by using Quantum Monte Carlo (SC-QMC), a new annealing method based on stochastic operation.

Application example



Processing speed evaluation for each bit size

Related Works

AI, artificial intelligence, machine learning, deep learning, optimization problem, neural network, annealing, etc.

IP Data

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