Optimizing Interaction Dynamics of the Analog Chaotic Solver for Boolean Satisfiability Problem

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Abstract

Many researchers have studied computation using nonlinear chaotic dynamics, in particular as an analog electric circuit. The ordinary differential equation system proposed by Ercsey-Ravasz and Toroczkai [1, 2] is one model for such application. The system consists of two parts: one part performs a gradient descent with respect to a target function that is reduced from the Boolean satisfiability problem and the other part concurrently changes the target function in time. Because of the latter part, the system is transiently chaotic and able to continue a search avoiding the local minima. In terms of realizing this system as an electric circuit or a possible other physical device, we investigated the issue of the balance of the operating speeds of the two parts. We proposed a variant of the system so that we can change the balance with a parameter and proposed a time measure for evaluating the computational performance. We found that if either part is faster than the other, the search fails or its efficiency is degraded.

References

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