

Accepted Manuscript

Bifurcation analysis of eight coupled degenerate optical parametric oscillators

Daisuke Ito, Tetsushi Ueta, Kazuyuki Aihara

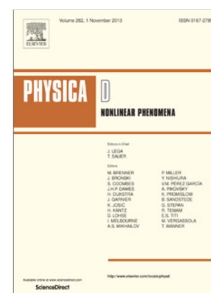
PII: S0167-2789(17)30323-8
DOI: <https://doi.org/10.1016/j.physd.2018.01.010>
Reference: PHYSD 32004

To appear in: *Physica D*

Received date: 13 June 2017
Revised date: 29 December 2017
Accepted date: 15 January 2018

Please cite this article as: D. Ito, T. Ueta, K. Aihara, Bifurcation analysis of eight coupled degenerate optical parametric oscillators, *Physica D* (2018), <https://doi.org/10.1016/j.physd.2018.01.010>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Bifurcation analysis of eight coupled degenerate optical parametric oscillators

Daisuke Ito^{a,b,*}, Tetsushi Ueta^c, Kazuyuki Aihara^d

^a Department of Electronic Systems Engineering, University of Shiga Prefecture, 2500 Hassaka-cho Hikone, Shiga, 522-8533, Japan

^b Department of Electrical, Electronic and Computer Engineering, Gifu University, 1-1 Yanagido Gifu, Gifu, 501-1193, Japan

^c Center for Administration of Information Technology, Tokushima University, 2-1 Minami-Josanjima Tokushima, Tokushima, 770-8506, Japan

^d Institute of Industrial Science, University of Tokyo, 4-6-1 Komaba Meguro-ku, Tokyo, 152-8505, Japan

Abstract

A degenerate optical parametric oscillator (DOPO) network realized as a coherent Ising machine can be used to solve combinatorial optimization problems. Both theoretical and experimental investigations into the performance of DOPO networks have been presented previously. However a problem remains, namely that the dynamics of the DOPO network itself can lower the search success rates of globally optimal solutions for Ising problems. This paper shows that the problem is caused by pitchfork bifurcations due to the symmetry structure of coupled DOPOs. Some two-parameter bifurcation diagrams of equilibrium points express the performance deterioration. It is shown that the emergence of non-ground states regarding local minima hampers the system from reaching the ground states corresponding to the global minimum. We then describe a parametric strategy for leading a system to the ground state by actively utilizing the bifurcation phenomena. By adjusting the parameters to break particular symmetry, we find appropriate parameter sets that allow the coherent Ising machine to obtain the globally optimal solution alone.

Keywords: bifurcation analysis, degenerate optical parametric oscillators, symmetry-breaking bifurcations

*Corresponding author

Email addresses: d_ito@gifu-u.ac.jp (Daisuke Ito), ueta@tokushima-u.ac.jp (Tetsushi Ueta), aihara@sat.t.u-tokyo.ac.jp (Kazuyuki Aihara)

Download English Version:

<https://daneshyari.com/en/article/8256232>

Download Persian Version:

<https://daneshyari.com/article/8256232>

[Daneshyari.com](https://daneshyari.com)