Algorithmic aspects of the reachability of conflicting chip firing game

Ha L.M., Tam N.A., Duong P.T.H.
Hue University's College of Education, 32 Le Loi, Hue, Viet Nam; Vietnam National University, 144 Xuan Thuy str, Cau Giay Distric, Hanoi, Viet Nam; Institute of Mathematics, 18 Hoang Quoc Viet, Hanoi, Viet Nam

Abstract: Chip-firing game is a cellular automaton model on finite directed graphs often used to describe the phenomenon of self-organized criticality. Here we investigate a variation of the chip-firing game on a directed acyclic graph G=(V, E). Starting from a given chip configuration, we can fire a vertex v by sending one chip along one of its outgoing edges to the corresponding neighbors if v has at least one chip. We study the reachability of this system by considering the order structure of its configuration space. Then we propose an efficient algorithm to determine this reachability. © 2010 Springer-Verlag Berlin Heidelberg.
Author Keywords: Conflicting chip firing game; Dynamic system; Energies; Multi agents system; Order filter; Order structure; Reachability; Self organization

Year: 2010
Source title: Studies in Computational Intelligence
Volume: 283
Page : 359-370
Link: Scorpus Link
Correspondence Address: Ha, L. M.; Hue University's College of Education, 32 Le Loi, Hue, Viet Nam; email: lemanhha@dhsphue.edu.vn
Editors: Nguyen N. T.Katarzyniak R.Chen S.
ISSN: 1860949X
ISBN: 9.78E+12
DOI: 10.1007/978-3-642-12090-9_31
Language of Original Document: English
Abbreviated Source Title: Studies in Computational Intelligence
Document Type: Conference Paper
Source: Scopus
Authors with affiliations:

- Ha, L.M., Hue University's College of Education, 32 Le Loi, Hue, Viet Nam
- Tam, N.A., Vietnam National University, 144 Xuan Thuy str, Cau Giay Distric, Hanoi, Viet Nam
- Duong, P.T.H., Institute of Mathematics, 18 Hoang Quoc Viet, Hanoi, Viet Nam

References:

- Meszaros, K., Peres, Y., Propp, J., Holroyd, A.E., Levine, L., Wilson, D.B., Chip-firing and rotor-routing on directed graphs. in and out of equilibrium 2 (2008) Progr. Probab., 60, pp. 331-364
- Bak, P., Tang, C., Wiesenfeld, K., Self-organized criticality (1988) Phys. Rev. A, 38, pp. 364-374
- Bianconi, G., Marsili, M., Clogging and selforganized criticality in complex networks (2004) Phys. Rev. e, 70, p. 035105

- Bjorner, A., Lovász, L., Shor, W., Chip-firing games on graphes (1991) E.J. Combinatorics, 12, pp. 283-291
- Cori, R., Rossin, D., On the sandpile group of a graph Eur. J. Combin., 21 (4)
- Lopez, M., Merino, C., Chip fring and the tutte polynomial (1997) Annals of Combinatorics, 1 (3), pp. 253-259
- Davey, B.A., Priestley, H.A., (1990) Introduction to Lattices and Order, , Cambridge University Press, Cambridge
- Diestel, R., (2005) Graph Theory, , Electronic edn., New York
- Dixit, S., Self-organization of complex networks applied to wireless world systems (2004) Wirel. Pers. Commun., 29 (1-2), pp. 63-70
- Le, M.H., Pham, T.A., Phan, T.H.D., On the relation between chip firing games and petri nets (2009) Proceeding of IEEE-RIVF International Conference on Computing and Communication Technologies, pp. 328-335
- Lipton, R.J., Cardoza, E., Meyer, A.R., Exponential space complete problems for petri nets and commutative semigroups (1976) 8th Annual Symposium on Theory of Computing, pp. 50-54
- Goles, E., Morvan, M., Phan, H.D., Lattice structure and convergence of a game of cards (2002) Ann. of Combinatorics, 6, pp. 327-335
- Le, M.H., Phan, T.H.D., Order structure and energy of conflicting chip firing game (2008) Acta Math. Vietnam., , to appear
- Huang, S.-T., Leader election in uniform rings (1993) ACM Trans. Programming Languages Systems, 15 (3), pp. 563-573
- Huynh, D.T., Commutative grammars: The complexity of uniform word problems (1983) Information and Control, 57 (1), pp. 21-39
- Keller, R.M., A fundamental theorem of asynchronous parallel computation (1975) LNCS, 24, pp. 102-112. , Tse-Yun F. (ed.) Parallel Processing. North-Holland, Amsterdam
- Lamport, L., Time, clocks, and the ordering of events in a distributed system (1978) Communications of the ACM (CACM), 21 (7), pp. 558-565
- Jones, N.D., Landweber, L.H., Lien, Y.E., Complexity of some problems in petri nets (1977) Theoretical Computer Science, 4, pp. 277-299
- Latapy, M., Phan, H.D., The lattice structure of chip firing games (2001) Physica D, 115, pp. 69-82
- Levine, L., Peres, Y., The rotor-router shape is spherical (2005) Math. Intelligence, 27 (3), pp. 9-11
- Magnien, C., Phan, H.D., Vuillon, L., Characterization of lattices induced by (extended) chip firing games (2001) Discrete Math. Theoret. Comput. Sci. AA, pp. 229-244
- Murata, T., Petri nets: Properties, analysis and applications (1989) Proceedings of the IEEE, 77 (4), pp. 541-580
- Epstein, I.R., Pojman, J.A., Steinbock, O., Introduction: Self-organization in nonequilibrium chemical systems (2001) Chaos, 2006 (16), p. 037101
- Pham, T.A., Phan, T.H.D., Tran, T.T.H., Conflicting chip firing games on directed graphs and on treese (2007) VNU Journal of Science. Natural Sciences and Technology, 24, pp. 103-109
- Huynh, D., Howell, R., Rosier, L., Yen, H., Some complexity bounds for problems concerning finite and 2-dimensional vector addition systems with states (1986) Theoretical Computer Science, 46, pp. 107-140