

**Vietnam Academy of
Science and Technology
Institute of Mathematics**

**Socialist Republic of Vietnam
Independence – Freedom – Happiness**

Summary of new results of PhD Thesis

Thesis title: Properties of stable configurations of the Chip-firing game and extended models.

Code - Speciality: 62 46 01 10 – Mathematical foundation for computer science.

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Advisor: Assoc. Prof. Dr. Phan Thi Ha Duong.

Educational institution: Institute of Mathematics, VAST.

The new results of the PhD thesis:

1. We give a necessary and sufficient criterion for the lattices generated by the Chip-firing game (CFG) model. We give a polynomial-time algorithm for determining whether a given lattice is generated by a CFG, and construct such a CFG if it is existent.
2. We give a connection between the problem of finding a minimum recurrent configuration and the problem of finding a minimum feedback arc set on directed graphs. We prove that both problems are NP-hard.
3. We give a generalization of a result of Criel Merino about the connection between the Tutte polynomial and the generating function of recurrent configurations on undirected graphs to Eulerian directed graphs.