Sandpile avalanche distribution on a wheel.

Arnaud Dartois [a] and Dominique Rossin [b]

[a] *LIX, École polytechnique, 91128 PALAISEAU Cedex, FRANCE*

[b] *CNRS, LIAFA, Université Paris 7,2 Place Jussieu, 75251 PARIS Cedex 05, FRANCE*

Abstract

This paper deals with the sandpile model on the wheel, a lattice with particular boundary conditions. Indeed, we compute the distribution of avalanches of the BTW model on the wheel and give some hints for other graphs. Moreover, we make some experiments which prove that the robustness of the model in the sense of complex systems is not obvious for general graphs.

Key words: Sandpile model, avalanche, wheel, lattice, critical group
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Introduction

The standard Abelian Sandpile Model (ASM) was introduced by Bak, Tang and Wiesenfeld [1] in 1987. This model, based on a cellular automaton, is the paradigm of a self-organized critical system. Its underlying algebraic structure was discovered by Dhar [2] and Creutz [3]. Other approaches to this model can be found in [4, 5, 6, 7].

We can briefly describe this model as follows : take a regular two-dimensional lattice and on each cell, put some grains. If the number of grains is greater or equal than four, then take four of the grains and put one on each of the neighbor's cell. We say that the - unstable - vertex topples. If a grain falls out of the lattice then it is lost. This corresponds to all boundaries open and could be represented by a special cell which could never be toppled. We call such a cell the *sink*. An addition of one grain can induce a high number of different topplings all over the lattice before reaching a stable configuration - a configuration with no unstable vertex -. This process is finite and is called *relaxation*. The multi-set of topplings involved during the relaxation is called the