

Projects for Computational Physics

Cellular automata for sandpiles

Project Description

The dynamics of sandpiles can be simulated using cellular automata [1,2]. If sand is added randomly, sandpiles evolve into a self-organised critical point by repeated avalanches. This statistically stationary state is characterised by distributions of avalanche lifetimes and avalanche sizes exhibiting power laws. The corresponding scaling exponents are key quantities to describe the nature of the self-criticality of this system and with the non-perturbative Monte-Carlo simulation approach they can be systematically studied for different dimensions.

Self-criticality can also be found in other, very different systems. However, the behaviour is similar in many respects.

Literature

- [1] P. Bak, C. Tang, K. Wiesenfeld, Phys. Rev. Lett. **59**:381 (1987)
- [2] “Dynamical and Spatial Aspects of Sandpile Cellular Automata”, K. Christensen, H.C. Fogedby, H. Jeldtoft Jensen, Journal of Statistical Physics, Vol. 63, Nos. 3/4 (1991)
- [3] M.B. Weissman, Rev. Mod. Phys **60**:537 (1988)