

Lubachevsky, Boris D.; Privman, Vladimir; Roy, Subhas C.

Casting pearls ballistically: Efficient massively parallel simulation of particle deposition.
(English) Zbl 0866.65099
J. Comput. Phys. 126, No. 1, 152-164 (1996).

This big paper focuses on computer simulation of a ballistic deposition model. In this model, continuous coordinates X and Y of the centers of unit-diameter spherical particles are generated randomly independently and uniformly over a substrate area, one particle at a time, while the coordinate Z is initially very large. After a particle is generated, it is “cast” vertically over a planar horizontal surface; that is, it moves straight down (X, Y are fixed, Z is decreasing) until it attaches itself to the obstacle met first. The obstacle may be either the planar surface of the underlying substrate (this substrate plane is placed at $Z = 0$), or it may be the surface of a previously dropped particle. Upon first contact each particle stops. The model is sequential, with particles deposited at deterministic discrete instances $t = 1, 2, \dots$ one by one. This model helps material scientists to study the absorption and sediment formation. The main interest in these simulation arises in the field of deposition of submicron particles on substrates.

New concepts and parallel programming techniques are introduced. The sequential ballistic deposition model is recast into a process where particles are deposited at asynchronous random instances in continuous time $t > 0$. This makes it amenable for parallel processing using a method similar to the one previously employed for simulation Ising spins. A comparison of the continuous time model with the model of asynchronous Ising spins is given. The enhancements to the original Ising spins simulation algorithm which boost efficiency of the task of producing the simulation trajectory are described.

In the last section the resulting algorithm on a 16K PE MasPar MP-1 and a 4K PE MasPar MP-2 is represented. Finally the authors summarize the present status of the problem of numerical simulation of ballistic deposition.

Reviewer: N.Semejko (Kiev)

MSC:

- [65C99](#) Probabilistic methods, stochastic differential equations
- [82C22](#) Interacting particle systems in time-dependent statistical mechanics
- [82C20](#) Dynamic lattice systems (kinetic Ising, etc.) and systems on graphs in time-dependent statistical mechanics
- [60K40](#) Other physical applications of random processes
- [65Y05](#) Parallel numerical computation

Cited in 1 Document

Keywords:

particle deposition; random process; parallel computation; computer simulation; ballistic deposition model; Ising spins

Full Text: [DOI](#)