A REVIEW OF PERFECT SIMULATION IN STOCHASTIC GEOMETRY

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Abstract

We provide a review and a unified exposition of the Propp-Wilson algorithm and various other algorithms for making perfect simulations with a view to applications in stochastic geometry. Most examples of applications are for spatial point processes.

Key Words: coupling from the past (CFTP), ergodicity, falling leaves model, horizontal CFTP, locally stable point processes, noisy point processes, read-once algorithm, spatial birth and death processes, vertical CFTP, Widom-Rowlinson model.

1   Introduction

One of the most important and exciting recent developments in stochastic simulation is perfect simulation. Following the seminal work by Propp and Wilson (1996), many papers have proven that perfect simulation algorithms are particular useful in stochastic geometry, spatial statistics and statistical physics. It seems timely to review this development with a view to applications in stochastic geometry.

   The aims of this paper are to provide such a review for readers with limited knowledge on perfect simulation, showing the mathematical details, and also to put things into a unified framework. From a mathematical view, the paper is self-contained, but in order to keep the paper within the limit of about 20 pages, no illustrative figures and empirical results are included (but the relevant references are provided). For the same reason I have chosen to focus on the Propp-Wilson algorithm, also called vertical coupling from