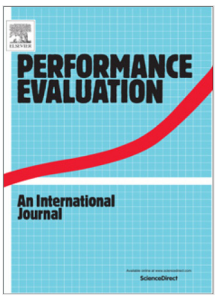
Accepted Manuscript



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PII: S0166-5316(17)30028-7
DOI: https://doi.org/10.1016/j.peva.2018.02.001
Reference: PEVA 1952

To appear in: *Performance Evaluation*

Received date : 23 January 2017
Revised date : 29 November 2017
Accepted date : 20 February 2018

Please cite this article as: A. Mouradian, Modeling dense urban wireless networks with 3D stochastic geometry, *Performance Evaluation* (2018), https://doi.org/10.1016/j.peva.2018.02.001

Modeling Dense Urban Wireless Networks with 3D Stochastic Geometry

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Abstract

Over the past decade, many works on the modeling of wireless networks using stochastic geometry have been proposed. Results about probability of coverage, capacity or mean interference, have been provided for a wide variety of networks (cellular, ad hoc, cognitive, sensors, etc). These results notably allow to tune network protocol parameters. Nevertheless, in their vast majority, these works assume that the wireless network deployment is flat: nodes are placed on the Euclidean plane. However, this assumption is disproved in dense urban environments where many nodes are deployed in high buildings. In this paper, we derive the exact form of the probability of coverage for the cases where the interferers form a 3D Poisson Point Process (PPP) and an approximation for the 3D Modified Matern Process (MMP). We compare the 3D model with the 2D model and with simulation results. We comment the adequacy of each model depending on the parameters of the nodes (emission power, reception threshold, MAC protocol, etc.) and the height of the buildings in the simulations.

Keywords: Urban Wireless Networks, 3D, Stochastic Geometry, CSMA

1. Introduction

Stochastic geometry has been largely used to study and design wireless networks, because in such networks the interference, and thus the capacity, is highly dependent on the positions of the nodes [1, 2]. Stochastic geometry indeed allows to take into account the spatial component for the analysis of wireless systems performance at a very low computational cost (in several