

On level crossings for a general class of piecewise-deterministic Markov processes

Konstantin Borovkov

Department of Mathematics & Statistics

Melbourne University

Parkville 3010

Australia

borovkov@unimelb.edu.au

Abstract

We consider a piecewise-deterministic Markov process governed by a jump intensity function, a rate function that determines the behaviour between jumps, and a stochastic kernel describing the conditional distribution of jump sizes. We study the point process of upcrossings of a level b by the Markov process. Our main result shows that, under a suitable scaling $\nu(b)$, as b tends to infinity, the point process converges weakly to a geometrically compound Poisson process. We also prove a version of Rice's formula relating the stationary density of the process to the level crossing intensities. This formula provides an interpretation of the scaling factor $\nu(b)$. While our proof of the limit theorem requires additional assumptions, Rice's formula holds whenever the (stationary) overall intensity of jumps is finite. (Joint work with G. Last.)