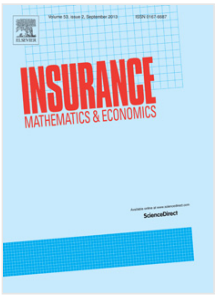
Accepted Manuscript



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PII: S0167-6687(15)00124-9
DOI: http://dx.doi.org/10.1016/j.insmatheco.2015.08.009
Reference: INSUMA 2124

To appear in: *Insurance: Mathematics and Economics*

Received date: October 2014
Revised date: July 2015
Accepted date: 21 August 2015

Please cite this article as: Dassios, A., Jang, J., Zhao, H., A risk model with renewal shot-noise Cox process. *Insurance: Mathematics and Economics* (2015), http://dx.doi.org/10.1016/j.insmatheco.2015.08.009

A Risk Model with Renewal Shot-noise Cox Process*

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August 26, 2015

Abstract

In this paper we generalise the risk models beyond the ordinary framework of affine processes or Markov processes and study a risk process where the claim arrivals are driven by a Cox process with renewal shot-noise intensity. The upper bounds of the finite-horizon and infinite-horizon ruin probabilities are investigated and an efficient and exact Monte Carlo simulation algorithm for this new process is developed. A more efficient estimation method for the infinite-horizon ruin probability based on importance sampling via a suitable change of probability measure is also provided; illustrative numerical examples are also provided.

Keywords: Risk model; Ruin probability; Renewal shot-noise Cox process; Piecewise-deterministic Markov process; Martingale method; Monte Carlo simulation; Importance sampling; Change of probability measure; Rare-event simulation

JEL Classification: G22, C10, C60

Mathematics Subject Classification (2010): Primary: 91B30; Secondary: 60J75, 65C05

1 Introduction

In insurance modelling a *Poisson process* has a long history of being used as a classical model for the claim-arrival process. Extensive discussions from both applied and theoretical viewpoints can be found in early literature, Cramér (1930), Cox and Lewis (1966), Bühlmann (1970) and Çınlar (1974). A Poisson process is a simple counting process that

*Submitted to the journal *Insurance: Mathematics and Economics*

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