



# Real Time Analysis of Signed Marked Random Measures with Applications to Finance and Insurance

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**Abstract:** This paper deals with stationary and independent increments processes in real time initiated in [14] embellishing it to a two-dimensional signed random measure with position dependent marking. The real-valued component of the associated marked point process is non-monotone presenting an analytical challenge. We manage to investigate various characteristics of that component, including the  $n$ th drop or a sharp surge that find applications to finance (like option trading) and risk theory. The need for time sensitive feature of our study (i.e., an analytical association with real time parameter  $t$ ) allows stochastic control implementation in sharp contrast with time insensitive analysis in the present literature. We proceed with the classical approach of fluctuation analysis of a particle running through a random grid of a convex set that the particle is trying to escape. We find the distribution of the first passage time and its location in space.

**Keywords:** *random walk; independent and stationary increments processes; fluctuations of stochastic processes; marked point processes; first passage time; signed marked random measures; time sensitive analysis.*

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## 1 Introduction

In many scientific, financial, and game theoretic processes, timing is of at most importance and a main strategic issue. Several studies have been done on the first passage time in fluctuation theory and their applications to queuing, stochastic games, seismology, and finance (cf. [1,2,8-10,11,12,13,15,16,19,22-24,27,30]). Fluctuation theory pertains to the behavior of an underlying process around a critical threshold and more generally, when a process escapes from a fixed manifold. The time when that passage takes place is referred

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