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## Topics on semi-Markov processes and their applications

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### **Abstract.**

While homogeneous Markov processes are well known and enjoy widespread applications, non-homogeneous Markov processes remain less well known. The situation is even worse when it comes to semi-Markov processes. Indeed, many articles often claim some confusing results about semi-Markov processes and their link with Markov processes both homogeneous and non-homogeneous. The most common mistake comes from the duration distribution in each state. A fruitful discussion with one of my supervisors brought my attention to this and motivated the ideas and approach presented here.

Most of the results in this presentation are not original as such. But the approach followed sheds light on many aspects of Markov processes and what differentiates homogeneous Markov, non-homogeneous Markov and semi-Markov processes. The idea is to present these processes as marked point processes. We then discuss all these processes following this approach and explain their specificities. Finally, we discuss why in certain topics (especially interest-rates models) semi-Markov processes seem more adapted to model the "real world".