FIRST PASSAGE PROCESS OF A MARKOV ADDITIVE PROCESS,
WITH APPLICATIONS TO REFLECTION PROBLEMS

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Abstract. In this paper we consider the first passage process of a spectrally negative Markov additive process (MAP). The law of this process is uniquely characterized by a certain matrix function, which plays a crucial role in fluctuation theory. We show how to identify this matrix using the theory of Jordan chains associated with analytic matrix functions. Importantly, our result also provides us with a technique, which can be used to derive various further identities. We then proceed to show how to compute the stationary distribution associated with a one-sided reflected (at zero) MAP for both the spectrally positive and spectrally negative cases as well as for the two sided reflected Markov modulated Brownian motion; these results can be interpreted in terms of queues with MAP input.

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