RANDOM SUMS STOPPED BY A RARE EVENT: A NEW APPROXIMATION

F. Gamboa
P. Pamphile

Abstract: The convergence of a geometric sum of positive i.i.d. random variables to an exponential distribution is a well-known result. This convergence provided various and useful approximations in reliability, queueing or risk theory. However, for concrete applications, this exponential approximation is not sharp enough for small values of mission time. So, other approximations have been proposed (Bon and Pamphile (2001), Kalashnikov (1997)). In this paper we propose a new point of view where the exponential approximation appears as a first-order approximation. We consider more general random sums stopped by a rare event, where summands are no more assumed to be independent neither nonnegative. So we give a second-order approximation. As illustration we consider stopping time with negative binomial distribution. This approximation provides a new evaluation tool in reliability analysis of highly reliable systems. The accuracy of this approximation is studied numerically.

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