

# Importance Sampling Methods with Stochastic Differential Equations for the Estimation of the Right Tail of the CCDF of the Fade Duration

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In this work, we explore using stochastic differential equations (SDEs) and Markovian projection to model signal envelope variations. Furthermore, it is of practical interest to study the performance of channels modeled by SDEs. Particularly, we investigate the fade duration metric, representing the time during which the signal remains below a specified threshold within a fixed time interval. We estimate the complementary cumulative distribution function (CCDF) of the fade duration using Monte Carlo simulations. We use at a first step importance sampling (IS) that delivers precise estimates of rare event probabilities with a reduced number of simulation runs, to estimate the tail of the CCDF efficiently. We also formulate a novel multilevel Monte Carlo method combined with IS, to reduce the cost of the IS estimator.