

Non-linear Renewal Theory with Stationary and Slowly Changing Perturbations

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ABSTRACT

We prove a non-linear renewal theorem for random walks that are perturbed by an approximately stationary sequence and a slowly changing sequence. Also we obtain the limiting joint distribution of the excess over the boundary and last perturbation, along with an approximation to expected first passage times. As an application, we consider a multicenter clinical trial where patients enter for treatment at random times; upon arrival, each patient is randomly assigned to one of the two treatments. We develop a sequential probability ratio test that compares the effects of treatments on patient's survival distribution while allowing for 'site' effects and censoring. Using Monte Carlo simulation, we determine the critical values of the test.

Key Words and Phrases: asymptotic distributions, censoring, likelihood function, random walks, staggered entry, sequential probability ratio test, multicenter clinical trial.