Asymptotic Expansions for Perturbed Discrete Time Renewal Equations and Regenerative Processes

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Abstract

This report contains two papers. In the first paper exponential asymptotic expansions for solutions of a perturbed discrete time renewal equation are given. Applications to studies of quasi- and pseudo-stationary ergodic theorems for distributions of perturbed discrete time regenerative processes with regenerative stopping times are discussed. Theoretical results are also illustrated by examples related to queuing systems and risk processes. In the second paper nonlinearly perturbed discrete time regenerative processes with regenerative stopping times are considered. We define the quasi-stationary distributions for such processes and present conditions for their convergence. Under some additional conditions, the quasi-stationary distributions can be expanded in an asymptotic power series with respect to the perturbation parameter. We give an explicit recurrence algorithm for calculating the coefficients of this asymptotic expansion. Applications to a perturbed alternating regenerative process with absorption are presented.