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Birth, immigration and catastrophe process

In a number of recent publications, studies have been reported on stochastic models for the growth of populations subject to catastrophes due either to death or large scale emigrations.

This paper is a sequel to Brockwell. In this model we consider a linear birth, immigration and catastrophe process, where the size of the population may increase due to the births by the individuals in the population may increase due to the births by the individuals in the population or by the arrivals of the immigrants. The size of the population will decease due to the deaths of individuals by catastrophes. We also

assume that the births, arrivals of immigrants and the occurring of catastrophes have independent Poisson processes.

Our objective of this study was to obtain the explicit results for stationary distribution, stationary probability and time to extinction of such process. Various extensions to the model studied are possible. Some of these are: (1) to obtain similar results for Binomial and Geometric catastrophes. (2) this result can be extended for a model with frequently occurring catastrophes

In this study we are interested to examine such processes under the influence of uniformly distributed catastrophe. If the catastrophe wiped out the entire population then it becomes extinct and the only way to increase the size of the population is by the arrivals of immigrants. The time to extinction of the process is defined by the first passage time to state zero.