MEAN TIME OF PERFORMANCE FOR PERISHABLE ITEMS

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Managing inventory of perishable or deteriorating items has received considerable attention in recent years; see a review by Bakker, Riezebos and Teunter [1]. Besides food products perishable inventory control covers also the behavior of radioactive materials (highly perishable goods).

Consider the following model. Let the number of independent demands $n >> 1$ during a time period T be a stationary process with expectation $E\{n\} = m_T$ and variance $Var\{n\} = \sigma_T^2$. For example, for stationary Poisson process with intensity λ the mean number and the variance of the number of demands are $m_T = \sigma_T^2 = \lambda T$. Demands values are assumed to be independent identically distributed non-negative random variables with finite first and second moments equals respectively a_1 and a_2. The items deteriorate continuously: at time interval $[t, t+\Delta t]$ an item deteriorates with a probability $p = k\Delta t + o(\Delta t)$ where κ is a deterioration rate coefficient per stocked item. We consider the diffusion approximation of the deterioration process $x(\cdot)$ with drift and variance equals $\kappa x(\cdot)$, and the diffusion approximation of the inventory level $Q(\cdot)$ satisfies the equation $dQ(t) = -(\kappa Q + m_0)dt + \sqrt{\sigma^2 + \sigma_0^2}\, dw_t$, where $m_0 = \lim\limits_{T\to\infty} \frac{a_1 m_T}{T}$,

$$\sigma_0^2 = \lim_{T\to\infty} \frac{m_T (a_2 - a_1^2) + \sigma_T^2 a_1^2}{T}.$$

Diffusion methods have been applied to inventory models in a variety of domains to begin with the papers by Bather [2] and Puterman [3]. The analogous diffusion approximation has been used by Kitaeva and Stepanova in [4]. Let $T(Q)$ be a mean of the product's remaining lifetime at the beginning of the production cycle T given that the initial inventory level is equal to Q. We derive the differential equation for $T(Q)$, and its asymptotic solution under $Q \gg 1$ is proposed.

To check the theoretical result we conduct the numerical simulation. The results of simulation and the relative mean square errors are given for normal and uniform batch size distributions for different lot sizes' values.

REFRENCES

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