Valéria Skřivánková

Contributions to the renewal theory of the things in operation [Abstract of thesis]

Commentationes Mathematicae Universitatis Carolinae, Vol. 26 (1985), No. 4, 839

Persistent URL: `http://dml.cz/dmlcz/106419`

ABSTRACTS OF CSc. (Candidatus Scientiarum) THESES IN MATHEMATICS defended recently at Charles University, Prague.

CONTRIBUTIONS TO THE RENEWAL THEORY OF THE THINGS IN OPERATION

V. SKŘIVÁNKOVÁ, Faculty of Nat. Sci., Šafárik Univ., Jesenná 5, 041 54 Košice, Czechoslovakia
(4.4. 1985, supervisor P. Mandl)

The thesis deals with the preventive replacement of machine parts in the case, when the distribution function $F(x)$ of their failure times is specified excepting an unknown parameter α. Optimality of the policy consists of minimalization of the average cost $t^{-1}C_t$.

In the first part the quasi-variational inequalities for the average cost (I)-(III) are investigated

(I) $w'(x) + g(x)(c_1 - w(x)) - \theta \geq 0$

(II) $c_2 - w(x) \geq 0$

(III) $(c_2 - w(x)).(w'(x) + g(x)(c_1 - w(x)) - \theta) = 0$,

where $w(x)$ is the cost potential, $w(0) = 0$, $g(x)$ the failure rate, $c_1(c_2)$ the cost of service (preventive) replacement and $\theta = \theta(d)$ the average cost per unit time corresponding to the policy with constant critical age $d = d(\alpha_0)$.

There are proved theorems of existence and uniqueness of the solution $w(x)$

$$w(x) = \begin{cases} (-c_1 F(x) + \theta \int_0^x \bar{F}(y)dy)/\bar{F}(x), & x \in [0,d] \\ c_2, \ x \geq d. \end{cases}$$

In the further part the asymptotic behavior of the average cost is investigated. We find the assumptions under which the maximum likelihood estimation of the parameter, $\hat{\alpha}_t$ converges to the true value of parameter α_0 almost surely by $t \to \infty$.

In the last part a more precise statement about the convergence of $\hat{\alpha}_t$ to α_0 is presented (by the law of iterated logarithm). The given conditions guarantee the best attainable convergence of the average cost $t^{-1}C_t$ to the optimum θ.

Corollary. In parametric situation it holds

$$\overline{\lim_{t\to\infty}} \pm (C_t - \theta.t)/\sqrt{2t \log \log t} = \sigma \qquad \text{a.s.},$$

where $\sigma^2 = \int_0^d (c_1 - w)^2 f_0 dy / \int_0^d \bar{F}_0 dy$ and $w(y)$ is the solution of quasi-variational inequalities (I)-(III).

THRESHOLD MOVING AVERAGE MODEL

A. FUCHS, Inst. of hygiene and epidemiology, Šrobárova 48, 100 42 Praha, Czechoslovakia
(11.7. 1985)

The abstract was published in Announcements of new results in Comment. Math. Univ. Carolinae 26,2(1985), p. 420.