ON A SINGLE-CHANNEL LOSS SYSTEM CONSIDERING THE RELIABILITY OF THE CHANNEL

by

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Summary

A single-channel service system is considered under the following conditions:

a) The arrival process is of Poisson type with parameter λ;

b) A call not finding the channel in a free state at the instant of its arrival will be lost; a call will be lost as well if before having finished its service the channel goes wrong.

Let $\omega(t)$ denote the life time of the service channel related to the moment in that the channel is free. For the reliability of the service channel we sssume

c)

$$\omega(t+\Delta t)-\omega(t)=\begin{cases}-\Delta t & \text{if in the interval } (t, t+\Delta t) \text{ the channel is free,}\\ -c\Delta t & \text{if in the interval } (t, t+\Delta t) \text{ the channel is occupied.}\end{cases}$$

Denote by π_1 the probability of the service channel being occupied at any given instant, by π_2 the probability of its being stopped for repair and by π_3 the probability of finding it in a free state.

It is proved under certain further conditions that these probabilities can be given as follows:

$$\pi_1=\varrho\int_0^\infty\Big(\int_0^{y/c} Z_c(y-cx)\,[1-F(x)]\,dx\Big)[1-H(y)]\,dy$$

$$\pi_2=\varrho\int_0^\infty[1-G(u)]\,du$$

$$\pi_3=\varrho\cdot 1/\lambda\cdot\int_0^\infty Z_c(y)\,[1-H(y)]\,dy$$

where

$$\varrho=\frac{1}{\int\limits_0^\infty[1-G(u)]\,du+\frac{1}{c}\int\limits_0^\infty\Big[1-\frac{c-1}{\lambda}Z_c(u)\Big][1-H(u)]\,du}$$

and

$$\bar{Z}_c(s)=\int_0^\infty e^{-su}Z_c(u)\,du=\frac{\lambda}{s+\lambda[1-\bar{F}(s)]},\quad \bar{F}(s)=\int_0^\infty e^{-su}\,dF(u)\,.$$