

Abstracts
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in TRANSPORTATION and COMMUNICATION

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ABSTRACTS

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INSPECTION PROGRAM FOR THE CASE OF TWO RANDOM PARAMETERS OF FATIGUE CRACK

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Limitation of fatigue failure probability (FFP) of fatigue-prone aircraft (AC) and fatigue failure rate (FFR) of airline (AL) is a problem of high priority. A lot of papers and books are devoted to this problem. In [1] the Markov Chains (MC) and Semi-Markov process with rewards (SMPW) theories are offered for its solution using exponential approximation of fatigue crack size growth function, $a(t) = \alpha \exp(Qt)$, where α , Q are parameters of fatigue crack trajectory (PFCT). The value Q defines the speed of fatigue crack size growth in logarithm scale: $\log(a(t)) = \log \alpha + Qt$. Despite of all the simplicity, this equation gives us rather comprehensible result in the range of observation $[T_d, T_c]$, where T_d is a time when the crack becomes detectable and T_c is the time when the crack reaches its critical size. We have $T_d = (\log a_d - \log \alpha) / Q = C_d / Q$, $T_c = (\log a_c - \log \alpha) / Q = C_c / Q$, where a_d is a crack size, when the probability to discover it is equal to unit, a_c is a crack size, which corresponds to the minimum residual strength of an aircraft component allowed by special design regulation. It comes from the additive property of the normal distribution that $\log T_c = \log C_c - \log Q$ could be normally distributed either if both $\log C_c$ and $\log Q$ ($C_c = \log a_c - \log \alpha$) are normally distributed (i.e. $X = \log Q \sim N(\mu_X, \sigma_X^2)$, $Y = \log C_c \sim N(\mu_Y, \sigma_Y^2)$) (with some coefficient of correlation r), or if one of them is normally distributed while another one is constant. Contrary to [1] in this paper we suppose that $(X, Y) = (\log(Q), \log(C_c))$ has two dimensional normal distribution with vector-parameter $\theta = (\mu_X, \mu_Y, \sigma_X, \sigma_Y, r)$. Numerical examples are given.

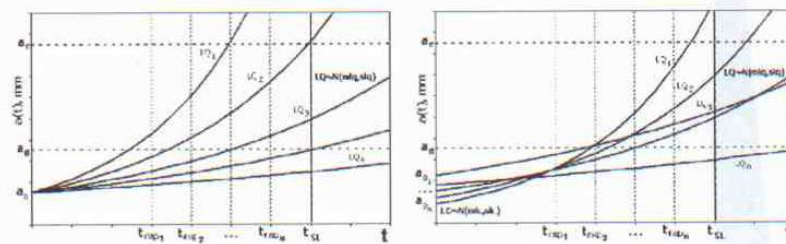


Figure 1. One- and two-parametric crack growth modelling ($LQ = \ln(Q)$)

References

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