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Latvian Transport Development and Education Association

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ABSTRACTS

Edited by

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Irina V. Yatskiv

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THE PROGRAMME COMMITTEE

ORGANIZATION COMMITTEE

Transport and Telecommunication Institute
Lomonosova iela 1, LV-1019, Riga, Latvia
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INSPECTION PROGRAM FOR THE CASE OF TWO RANDOM PARAMETERS OF FATIGUE CRACK

Maris Hauka, Yury Paramonov

Aviation Institute, Riga Technical University
Lomonosova 1B, Riga, LV-1019, Latvia
Ph.: +371 26276057. Fax: +371 7089990
E-mail: maris.hauka@gmail.com; yuri.paramonov@gmail.com

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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.

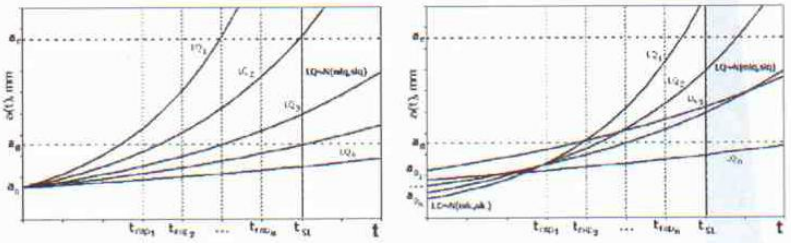

Figure 1. One- and two-parametric crack growth modelling (LQ = ln(Q))

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