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BOOK OF ABSTRACTS

**MECHANICS
OF COMPOSITE MATERIALS**

**JUNE 2 - 6, 2014
RIGA, LATVIA**



**INSTITUTE OF POLYMER MECHANICS
UNIVERSITY OF LATVIA**

**EIGHTEENTH INTERNATIONAL CONFERENCE
MECHANICS OF COMPOSITE MATERIALS**

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Eds. V. Tamužs, K. Cīrule, and V. Kulakovs

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MODELLING OF STRENGTH AND FATIGUE LIFE OF UNIDIRECTIONAL FIBRE COMPOSITE USING DANIELS' SEQUENCE AND MARKOV CHAINS

Yu. Paramonov, V. Cimanis, S. Varickis, and M. Kleinhofs

*Aeronautical Institute, Riga Technical University, Lomonosova 1, Riga LV 1019, Latvia
Corr. author. Tel. +371 7255394. E-mail: yuri.paramonov@gmail.com*

Generalization of definition of Daniels' sequence (DS) for analysis of connection of static strength distribution of composite components with distribution of fatigue life and now static strength distribution of composite of unidirectional fibre composite (UFC) itself is presented.

The process of loading in general case is described by sequence of nominal stress $s_{i,\infty}^+ = \{s_i^+, i=1,2,\dots\}$. Local stress in weak micro volume (WMV) in which the accumulation of destruction takes place is described by sequence $s_i = s_i^+ / (1 - \hat{F}_{X_L}(s_{i-1}))$. $s_0 = s_1^+$, $i=1,2,\dots$, where $\hat{F}_{X_L}(s)$ is estimate of cumulative distribution function on the base of sample $x_{L,1:n} = (x_{L,1}, \dots, x_{L,n})$, where $x_{L,i}$ is the local strength of some strong component of WMV, which can be lower than the strength of isolated component. For fatigue test modeling, all items of sequence $s_{i,\infty}^+ = \{s_i^+, i=0,1,2,\dots\}$ are equal to some constant s^+ (parameter of mode of fatigue loading; maximum stress of cycle, for example). For static strength test modeling, items of sequence $s_{i,\infty}^+$ are increasing up to infinity.

The model of static strength test of UFC, as distinct from Daniels' model, takes into account the rate of loading and the randomness of number of still intact components in WMV in which the destruction process takes place. For analysis of fatigue life, it is possible to explain a phenomenon of fatigue limit and to calculate the maximum stress level at which the fatigue failure can be eliminated with required probability when cycles number of fatigue loading tends to approach infinity. Numerical examples of parameter estimation of corresponding regression models are given, which can be interpreted as parameters of strength structure of UFC.

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