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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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CONNECTION OF TENSILE STRENGTH AND FATIGUE DURABILITY OF GLASS-FIBER REINFORCED COMPOSITE AND DANIELS' SEQUENCE

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Connection between the cumulative distribution function (cdf), $F_X(s)$, of random variable (r.v.) X , which is the tensile strength of longitudinal items (LI) (fibers or strands) of unidirectional glass-fiber reinforced composite material (UGFRCM), and fatigue durability of this material can be defined by the random Daniels' sequence $\{s_0, s_1, s_2, \dots\}$, $s_{i+1} = s / (1 - \hat{F}_X(s_i))$, $i = 0, 1, 2, \dots$, where $s_0 = s$, s is maximum value of cyclic stress, $\hat{F}_X(s)$ is estimate of $F_X(s)$ using results of tensile strength test of n LIs. RDS is non-decreasing sequence but there are two types of RDS. For RDS_1, when $s > \max x(1 - \hat{F}_X(x))$, items of RDS increase up to infinity. The corresponding residual stress $r(i)$ decreases and there is such i^* that $r(i^*) > s$ but $r(i^* + 1) < s$. This condition of failure is different from the condition used in our previous publications in which it was defined as moment when $s_{(i)}$ exceeds some specific level independently on s . The value of $N_D = i^*$ we call as random Daniels fatigue life. For RDS_2, when $s < \max x(1 - \hat{F}_X(x))$, there is such smallest i^{**} that $s_{(i^{**} + 1)} = s_{i^{**}}$. The inequality $r(i^* + 1) < s$ will be never reached and N_D is equal to infinity. The maximum value of s for which this phenomenon takes place we call random Daniels fatigue limit: $S_D = \max x(1 - \hat{F}_X(x))$. Dependence of N_D on s and definition of S_D can be successfully used for regression analysis and fitting fatigue test results and some predictions.

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