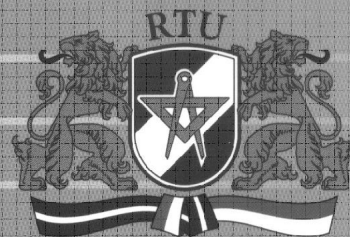


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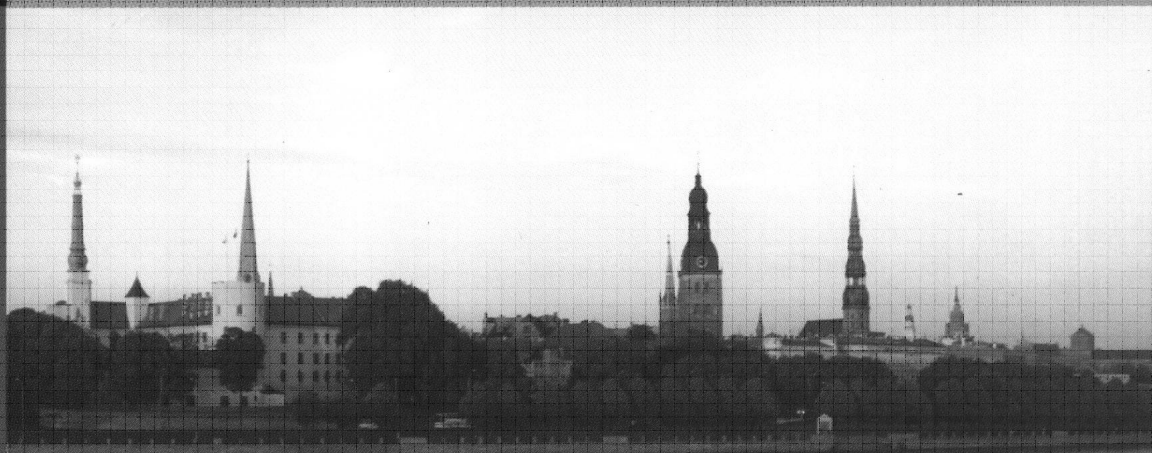


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CORRELATION OF ACOUSTIC EMISSION SIGNALS WITH KINETICS OF FATIGUE CRACK GROWTH IN THE SHOCK ABSORBER OF AIRCRAFT LANDING GEAR

AKUSTISKĀS EMISIJAS SIGNĀLU KORELĀCIJA AR NOGURUMA PLAISAS AUGŠANAS KINĒTIKU LIDMAŠĪNAS ŠASIJAS AMORTIZATORĀ

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Key words: acoustical emission, fatigue cracks, fractography, landing gear

Abstract: In this article it is analyzed possibility of correlation between acoustic emission (AE) parameters and characteristics of fatigue crack development beginning from moment of crack initiation before didruption. A shock absorber cylinder of aircraft landing gear leg was used as object of investigation. In process of testing the fatigue crack was grew during action of periodic loading which imitates full flight cycle including take-off and landing and running at the ground. This testing was finished by destruction of the piston rod of shock absorber. Different AE parameters have been measured during object loading. It was noted great irregular changes of AE parameters in the different stages of loading. Correlation of AE signal and crack growth development was set by fractal analysis, which carried out by electron-scan microscope and X-ray spectrum analyzer. The relief morphology changes and spectral characteristics of material are researched. It was found that fatigue destruction was begun from internal surface and an intra-grain crack has been initiated by the initial destruction of the material. It is shown that cumulative AE may be used for determination of initiation of fatigue cracks and principal stages of their development.

Introduction

The arising of fatigue cracks in structure elements of aircraft landing gear during the operation happens for various reasons, and as a rule it is connected with the crack growth on the surface of a part [1]. The loading of some landing gear structure elements is implemented in few-cycle fatigue (FCF) area, when operation duration is estimated by the number of loading flight cycles (LFC). The confirmation of the veracity of service duration estimations is carried out by way of conducting part bench testing after operation running of the parts. The testing is carried out according to the special equivalent cyclical programs taking into account the most intensive stages of the loading of a part. In this case, it is very important to estimate causes, due

to which occurs the destruction of a structure element in the process of bench testing.

Technique of experiment

There was investigated a fragment of shock absorber rod of the principal landing gear support of medium-range aircraft for the purpose of the genesis of a fatigue crack and the duration of its spreading determination. The rod as a part of the landing gear, endured in operation 6501 landings from the beginning of the operation, and then it underwent bench testing. The testing program implied the imitation of Earth-Air-Earth (EAE) cycle, which is characteristic for loading during operation. The testing program was formed in such way that it included the imitation of all strut loading stages during the flight, Fig. 1.

Results of experiment

During the testing process there was carried out Acoustic Emission (AE) Control of the state of the rod, and there were discovered changes in the accumulation of signals on the graph resultant for the loading period from 18712 to 38568 units, which were dated to the period of the arising of the fatigue crack. After a plateau arisen on the acoustic graph, beginning from 42000 loading units and up to approximately 45000 units, was taking place intensive growth of total AE signal, Fig. 2 (two piezo-electric transformers were used: AE1 and AE2).

Such a character of AE signal accumulation was interpreted as a characteristic of the intensive process of the growth of the crack. Further was also observed AE increment up to the end of the