USE OF STRUCTURAL STRESS RATE FACTORS FOR AERONAUTICAL COMPOSITE STRUCTURES FATIGUE PROPERTIES ASSESTMENT

Mirosław Rodzewicz, miro@meil.pw.edu.pl

Warsaw University of TechnologyFaculty of Power and Aeronautical Engineering
Institute of Aeronautics and Applied Mechanics Nowowiejska 24, 00-665 Warsaw, POLAND,

Abstract: There is presented the author's method named as Relative Fatigue properties Reduction (RFPR) created for fatigue properties assessment of aeronautical composite structures, especially the structures having nodes of concentrated force introduction (NCFI). Author focused his attention on a special kind of such node named as labyrinth non-adhesive node of concentrated force introduction (LNA-NCFI), which is applied in certain composite gliders for fitting glider wings with the fuselage. The RFPR method is based on the use of Structural Stress Rate factors (SSR) belonging to the family of lightness factors, where stress values are referred to the structural mass. The lightness factors allow comparing in an easy manner the strength properties of quite different materials subjected to the same load. The author extended the application of the SSR on fatigue evaluations. In order to do it, the High diagrams presenting fatigue properties for pure composite shells were rescaled and the SSR factors were used instead of mean and alternate values of stress or strain appearing on the High diagram. Thus basing on fatigue properties of the coupons of certain pure composite shells subjected to cyclic loads, and basing on the static strength difference between pure composite shells and the same shells having the structure affected by the LNA-NCFI - new High diagrams were developed. The author showed that even the static strength difference between pure composite shell and the shell having LNA-NCFI differs by tens of percent; the fatigue life may vary of about 1 order for the same load spectrum. The result of RFPR method application matched well with the results of fatigue tests of the LNA-NCFI type of a node of concentrated force introduction, which were done by the author in the past. All those results together with the effects of RFPR method implementation are included to the presentation.

Keywords: Composite, structure, fatigue, gliders, strength, load-spectra, structural node, High diagram