

**Structural health monitoring.
A new paradigm in the assessment structural integrity.**

**Monitorizarea sănătății structurale.
O nouă paradigmă în evaluarea integrității structurale.**

Prof. Dr. Ing Dragos D. Cioclov

Saarbrücken, Germany, Timisoara, Romania.

Abstract

Intermittent non-destructive inspection has been used since long time for checking the integrity of load-carrying structures and mechanical components. With the tremendous contemporary development of sensors technology, in conjunction with advanced wireless communications and the support of the massive computation facilities, continuous monitoring of structural damage during operation and time-continuously assessment of structural integrity, for the prediction of structural remnant life, in conditions of reliable and optimized costs of operation, is, nowadays, a vigorous endeavor for the next years to come. The lecture tries an overview of the scientific and engineering bases of Structural Health Monitoring (SHM) comparatively with the traditional approach to structural inspection and reliability assessment, outlining that beyond the new sensing sophisticated technology, much of the well-established methods based on models derived from fracture mechanics, non-destructive testing evaluation in probabilistic quantitative terms, are naturally integrated in SHM technology. The presentation is focused on civil aircraft structures outlining how the conjoint construct of Probabilistic Fracture Mechanics (PFM) conjointly with the methods of quantitative non-destructive inspection (NDI) is implemented in SHM evaluations by the means of massive computer simulations. Probabilistic substantiated of the warning time at the attainment of various levels of fatigue crack extension in the skin of a fuselage structure is assessed in circumstances when a generic SHM system is implemented. A comparison of failure risk prediction is presented when aircraft operates under risk management by intermittent NDI at scheduled inspection time (when the aircraft is grounded) and continuous in time by SHM. The reported results are intended to demonstrate that by integration of existing assessment methodologies of PFM and quantitative NDI, paralleling SHM data acquisition by massive computer simulation, it results refined prognostications and management of failure risks with better insight on how to optimize operational costs.