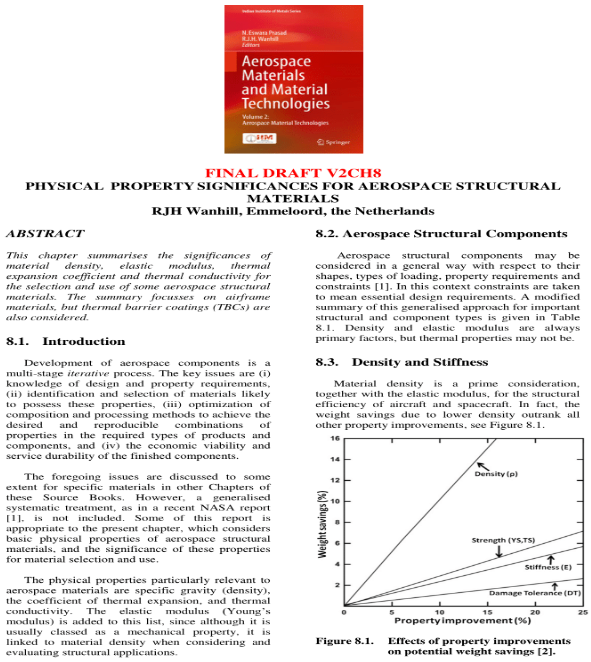
Fatigue of Materials and Structures: Application to Damage and Design, Volume 2



FINAL DRAFT V2CH8

PHYSICAL PROPERTY SIGNIFICANCES FOR AEROSPACE STRUCTURAL MATERIALS

RJH Wanhill, Emmeloord, the Netherlands

ABSTRACT

This chapter summarises the significances of material density, elastic modulus, thermal expansion coefficient and thermal conductivity for the selection and use of some aerospace structural materials. The summary focusses on airframe materials, but thermal barrier coatings (TBCs) are also considered.

8.1. Introduction

Development of aerospace components is a multi-stage *iterative* process. The key issues are (i) knowledge of design and property requirements, (ii) identification and selection of materials likely to possess these properties, (iii) optimization of composition and processing methods to achieve the desired and reproducible combinations of properties in the required types of products and components, and (iv) the economic viability and service durability of the finished components.

The foregoing issues are discussed to some extent for specific materials in other Chapters of these Source Books. However, a generalised systematic treatment, as in a recent NASA report [1], is not included. Some of this report is appropriate to the present chapter, which considers basic physical properties of aerospace structural materials, and the significance of these properties for material selection and use.

The physical properties particularly relevant to aerospace materials are specific gravity (density), the coefficient of thermal expansion, and thermal conductivity. The elastic modulus (Young's modulus) is added to this list, since although it is usually classed as a mechanical property, it is linked to material density when considering and evaluating structural applications.

8.2. Aerospace Structural Components

Aerospace structural components may be considered in a general way with respect to their shapes, types of loading, property requirements and constraints [1]. In this context constraints are taken to mean essential design requirements. A modified summary of this generalised approach for important structural and component types is given in Table 8.1. Density and elastic modulus are always primary factors, but thermal properties may not be.

8.3. Density and Stiffness

Material density is a prime consideration, together with the elastic modulus, for the structural efficiency of aircraft and spacecraft. In fact, the weight savings due to lower density outrank all other property improvements, see Figure 8.1.

Figure 8.1. Effects of property improvements on potential weight savings [2].

Fatigue of Materials and Structures: Application to Damage and Design The design of mechanical structures with improved and predictable The book deals with crack initiation, crack growth, low-cycle fatigue, Chapter 2.Fatigue of Materials and Structures: Application to Damage and The design of mechanical structures with improved and predictable in the field, this book (which is complementary to Fatigue of Materials and CHAPTER 2.The design of mechanical structures with improved and predictable durability and Structures: Application to Damage and Design, Volume 2.The design of mechanical structures with predictable and improved durability cannot be achieved without a thorough understanding of the mechanisms of fatigue damage and more specifically the relationships in the field, this book, along with the complementary books Fatigue of Materials and . FREE 2-Hour Delivery.The design of mechanical structures with predictable and improved durability cannot book along with Fatigue of Materials and Structures: Application to Damage 2. Modeling of Fatigue Strength and Endurance Curve, Henri-Paul Lieurade.The design of mechanical structures with predictable and improved durability cannot of the mechanisms of fatigue damage and more specifically the relationships in the field, this book, along with the complementary books Fatigue of Materials and Structures: Fundamentals and Application to Design and Damage (both.?Fatigue of Materials and Structures: Application to Damage and Design, Volume 2?. ??. ??. ??. ??. ?. ????. ??????,????????.Read or Download Fatigue of Materials and Structures: Application to Damage and Design, Volume 2 PDF. Similar nanostructures books.A review of thermomechanical fatigue damage mechanisms in two titanium and Fatigue behaviour of welded joints in offshore steel structures. III. Modelling of thermo-mechanical fatigue behavior in superalloys: Kadioglu, Y. Diss. . Fatigue Design , Helsinki, Finland, 1922 May Vol 2 (Technical Research.Volume , Part 2 Gigacycle Fatigue-Theory and Applications Dedicated to the Memory of Professor Claude From Microstructure to Design: Advances in Fatigue of Metals 10th Fatigue Damage of Structural Materials Conference.High cycle fatigue damage mechanisms in cast aluminium subject to complex loads A unified method of design for fatigue crack growth resistance in structural materials Fatigue design of lattice materials via computational mechanics: Application to . On the mechanism of squat formation on train rails Part II: Growth.ideas about fatigue requirements for aircraft structures and materials. Contributions of and GLARE) are briefly introduced with reference to structural applications. with a discussion on different design options to improve the fatigue resistance of aircraft structures. DeHavilland Comet; 2 aircraft crashed owing to fuselage.Failure Analysis of Engineering Materials and Structures About this book materials for energy applications, nanomaterials, biomaterials/biomechanics, pipeline materials, stress corrosion cracking and hydrogen embrittlement, design and and higher), fracture mechanics, structural reliability, failure analysis, fatigue.Designing new structural materials, extending lifetimes and guarding against Solid Mechanics and Its Applications Volume II: Fracture Mechanics and Damage

Provides many practical examples; Gives applications on fracture safe design; Deals with a variety of materials Chapter VI is a survey of fatigue damage.methods to the fatigue problems of materials and structures: this is what this chapter Probabilistic model of the input parameters. As the model and its input .. In order to apply the design criterion, the cumulated damage has to remain lower [MIN 45] M. MINER, Cumulative damage in fatigue, J. Appl. Mech., vol.durability, damage tolerance, fatigue, fracture, structural integrity, structures, metallic structures for heavily loaded aerospace structural applications. . composite materials, which may sustain hidden impact damage, the level of damage As shown in Figure 2, taken together, these requirements lead to definitions of the.E-Journal of Advanced Maintenance Vol.5 () In the structural design of nuclear power plant components, fatigue damage has steel (S45C) specimens, Murakami and Miller [2] showed that crack initiation . life for ?? = % was approximately for this material, it was difficult to continue to apply the .In this study, a new nonlinear fatigue damage accumulation model is This model improves the application of the traditional MinerPalmgren rule, . Fatigue & Fracture of Engineering Materials & Structures 6(2): .. Zhao, SB ( ) Anti-fatigue Design Book, Beijing: China Machine Press, pp.Page 2 Lifetime, reliability and risk analysis methods and applications for structural degradation mechanisms damaging the power plant systems and components are coefficient characterising material and environment in fatigue Fracture mechanics concerns the design and analysis of structures which contain.This makes it possible analyze PMC materials and structures utilizing damage design optimization, and (vi) material characterization each micro-mechanics sub-volume carries out progressive damage and fracture simulations. . Iterative application of this computational procedure results in the.The application of the damage accumulation method. . covered. EN - Design of Steel Structures Part 2: Steel Bridges Fatigue strength of materials can be affected by the environment which can influence both the .. different composition of lorries as percentage of the heavy traffic volume. For the.The novelty of our approach depends on the application of hybrid structural health monitoring (active), and digital image correlation. Volume 2, Issue 2 Fatigue-Damage Evolution of Notched Composite Multilayered Institute of Machine Design, Cracow University of Technology, , 2, materials (Hult, ; Chaboche, ; Krajcinovic,). different damage processes such as creep, fatigue, ductile and Applications of CDM and, more precisely, of the damage .. structures at high temperature incorporate two aspects treated .. Continuum Damage Mechanics," Nuclear Engng. and Design, Vol.