Preface

The first edition of the book Advanced Aerospace Materials was published in 2019 and it was aimed at dissemination of advanced engineering ideas using isotropic and composite materials. The book was written to provide students and scholars a good understanding of new emerging technologies using composite materials, mainly in the aerospace sector. It can serve as an introductory book for graduate students wishing to study about composite made structures, enabling them to acquire the necessary physical and mathematical tools to understand the various aspects of composite based structures as compared to isotropic ones. The book was based on the various studies and investigations performed during the years by the author on metal and composite structures.

The second edition of the book aims at updating the content of the first edition based on additional research performed by the author on smart structures and innovative research published in the literature during the past 5 years.

The second edition of the book contains ten chapters from the first edition namely: an extended introductory on thin walled structures, characterizing aerospace and aeronautical structures. The chapter stresses the transition from aluminum-based structures to laminated composite ones, to save weight. An introductory to elasticity topics and equations of motion is also presented to enable the understanding of structural analysis of aerospace-aeronautical structures. Chapter 2 is devoted to laminated composite materials, and presents the classical lamination theory and the first order shear deformation theory. This chapter aims at providing mathematical and physical insight of composite materials. To complement this topic, higher order theories are also displayed. The 3rd Chapter is devoted to some design formulas to be used by engineers on solving various problems of thin walled structures. Fatigue issues are presented in Chapter 4 of the book. This chapter presents introductory topics in this well documented subject of engineering. The crack propagation subject is described and reviewed in the 5th Chapter of the book, thus complementing the topics presented in Chapter 4, enabling the reader to understand and use the various equations to predict the life of a single structural component. The 6th Chapter displays various issues for the buckling for columns and plates, using isotropic and laminated composite materials. A new subchapter 6.5 dealing with buckling of shell structures was added in the present edition. A complementary chapter, Chapter 7, presents the vibrational aspects for the structures presented in the previous chapter, with an additional subchapter 7.5 been added to deal with vibration of shells. Another important topic in the analysis of thin walled structure, the dynamic buckling of structural components due to pulse loading, is described and presented in detail in Chapter 8, highlighting both analytical and experimental aspects of the subject. Chapter 9 initiates the reader to the optimization of thin-walled structures issues, while Chapter 10 deals with structural health monitoring topic.

Five new chapters were added to the second addition of the book: Chapter 11 describing one of the most applied nondestructive experimental method to determine

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buckling of thin walled structures, the VCT (Vibration Correlation technique) method. This chapter presents in detail for the first time the application of the VCT to shear loaded plates; Chapter 12 is devoted to another important issue, namely the morphing of flying vehicles, with a dedicated example being discussed in this chapter; Chapter 13 displays the topic of large deflections for columns, beams and plates; Chapter 14 presents the shearography and acoustic emission non-destructive testing (NDT) methods for metal and laminated composite structures, while the last chapter, Chapter 15 deals with a useful method which monitors the natural frequency of a structure to yield its material properties.

I wish that this 2nd edition book, together with other books and the huge numbers of references existing in the literature, would enable readers to become familiar with the treatment of thin walled structures, and how to investigate and calculate their structural behavior.

I would like to thank all my former graduate students for their dedicated research in the field of composite based structures, morphing, large deflected structures and NDT methods, Mr. Joshua Harris, Mr. Osher Shapira, Mr. Amit Geva, Mr. Gilad Hakim, Mr. Yair Elbaz and Mr. Yaniv Seri for their contributions to the present book.

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