

Preface

Composite materials are composed of two or more kinds of materials with different properties. Through physical or chemical methods, these composite materials have new properties. The comprehensive properties of composite materials are better than those of raw materials, so as to meet different requirements. The history use of composite materials can be traced back to ancient times. Straw or wheat straw reinforced clay and reinforced concrete, which have been used for hundreds of years, are composed of two materials. In the mid-1960s, carbon fiber reinforced composites came into being, and they were used in aircraft structures in the early 1970s. Compared with the traditional materials, composite materials have the characteristics of high specific strength and specific modulus, good fatigue resistance, designability, and the identity of materials and structures. The application of composite materials in aircraft structure has been improved continuously. The amount of composite materials used in Airbus A350 is close to 40% of the total mass. The composite materials used in the wing and fuselage of Boeing 787 are more than 50%. Only carbon fiber composites used on fuselage panel for Airbus A380 is more than 30 tons.

The first concern of civil aviation is flight safety. Aviation administrations have been set up all over the world, and airworthiness regulations have been drawn up for civil aviation, and the safety requirements of civil aircraft have been scientifically and reasonably classified. Airworthiness refers to the quality of flight safety and physical integrity of civil aircraft (including the overall performance and control performance of its components and subsystems) under the expected service environment and use restrictions. This quality requires that the aircraft should always be in accordance with its model design standards and always in safe operation. This book introduces the theories and methods involved in the field of airworthiness design of composite structures for civil aircraft, including:

Chapter 1 is about general information about composite materials: history of their development, classification and composition.

Chapter 2 is about composite materials' components specifics; matrix and reinforcement performance for different composite materials type.

Chapter 3 is about main types of composite materials' production. There are descriptions about different production processes and their specifics.

Chapter 4 is about mechanical behavior of polymer composite materials.

Chapter 5 is about joints application in composite materials and their specifics.

Chapter 6 is about repair processes for composite materials parts according to their structural features.

Chapter 7 is about composite materials parts, units and products safety analyzing. There are descriptions about composite materials testing processes. Also, specifics of composite materials structures certification are given.

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