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Aircraft with Composite Material

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ABSTRACT: This research has focused on the evaluation of raw materials that used in that used in the wing f modern airplane.: Most aircraft wings have traditionally been constructed from aerospace- grade aluminum and, more recently, composite materials such as carbon fiber. Both these materials have an extremely high tensile strength, ensuring that wings can sustain far more than any conditions seen during any flight. Composites materials are intended to be used more extensively as an alternative to aluminum structure in aircraft and aerospace applications. This is due to their attractive properties such as high strength-to-weight ratio and flexibility. The design of a general aviation aircraft is initially implemented in the first section.

KEYWORDS: Ceramic matrix; composites Fibre-reinforced; polymersMDOMetal;matrix composites Structural analysis Structural design

I. INTRODUCTION

A composite material is composed of at least two materials, which combine to give properties superior to those of the individual constituents. For our website we refer to fibre reinforced polymer (frp) composites, usually with carbon, glass, aramid, polymer or natural fibres embedded in a polymer matrix. Composite materials are formed by combining two or more materials that have quite different properties.

The different materials work together to apart – they do not dissolve or blend into each other give the composite unique properties, but within the composite you can easily tell the different materials.

There are various reasons where new material can be favoured. Typical examples include materials which are less expensive, lighter, stronger or more durable when compared with common materials, as well as composite materials inspired from animals and natural sources with low carbon footprint.

More recently researchers have also begun to actively include sensing, actuation, computation, and communication into composites which are known as robotic materials.

Composite materials are generally used for buildings, bridges, and structures such as boat hulls, swimming pool panels, racing car bodies, shower stalls, bathtubs, storage tanks, imitation granite, and cultured marble sinks and countertops. They are also being increasingly used in general automotive applications.

The most advanced examples perform routinely on spacecraft and aircraft in demanding environments.

IT'S NOT A NEW IDEA

Humans have been using composite materials for thousands of years. Take mud bricks for example. If you try to bend a cake of dried mud, it will break easily but it is strong if you try to squash, or compress it. A piece of straw, on the other hand, has a lot of strength when you try to stretch it but almost none when you crumple it up. When you combine mud and straw in a block, the properties of the two materials are also combined and you get a brick that is strong against both squeezing and tearing or bending. Put more technically, it has both good compressive strength and good tensile strength.



A man reconstructing an ancient mud brick citadel

Iran after it was damaged

earthquake. The

mud

bricks are the same materials that were used to construct it around 2,500 Year ago

II. STRUCTURAL STRESSES

LEARNING OBJECTIVE : IDENTIFY the five basic stresses acting on an aircraft. The primary factors to consider in

aircraft structures are strength, weight and reliability. These factors determine the requirements to be met by any material used to construct or repair the aircraft. Airframes must be constructed or repaired. Airframes must be strong and light in weight. An aircraft built so heavy that it could support more than a few hundred pounds of additional weight would be a man reconstructing an ancient mud brick citadel in Iran after it was damaged in an earthquake. The mud bricks are the same materials that were used to construct it around 2,500 years ago.

Image source: Stresses on the wings, fuselage, and landing gear of aircraft are tension, compression, shear, bending, and torsion. These stresses are absorbed by each component of the wing structure and transmitted to the fuselage structure. The empennage (tail section) absorbs the same stresses and transmits them to the fuselage. These stresses are known as loads, and the study of loads is called a stress analysis.



Structural Stress Acting on an Aircraft

Bending Action occur due to combination of compression & tension loads.

Tension outside bend
Shear in the middle
compression inside bend

Torsional stress
Propeller Rotation

Torque from engines Apply Torsional stress on Aircraft Fuselage

My Aviation Book - An Aviation Book Like No Other

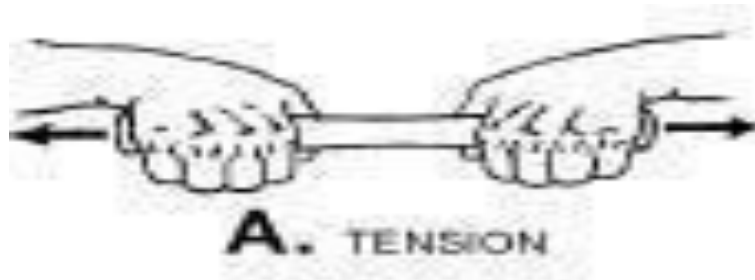
Author
D. Wijegumarathna

Stresses are analyzed and considered when an aircraft is designed. The stresses acting on an aircraft.

TENSION

Tension is the stress that resists a force that tends to pull something apart. The engine pulls the aircraft forward, but air resistance tries to hold it back. The result is tension, which stretches the aircraft.

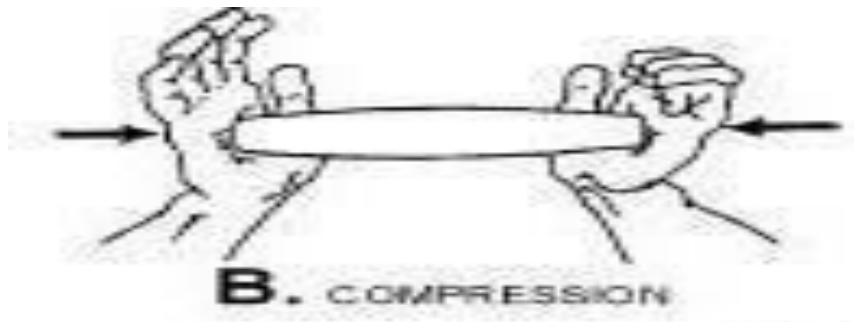
. For example, an elevator control cable is in additional tension when the pilot moves the control column.



COMPRESSION

Compression is the resistance to crushing produced by two forces pushing toward each other in the same straight line

For example, when an airplane is on the ground, the landing gear struts are under a constant compression stress.



TORSIONAL

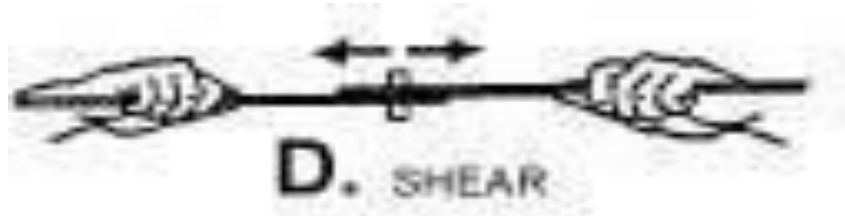
Torsion is the stress that produces twisting. While moving the aircraft forward, the engine also tends to twist it to one side, but other aircraft components hold it on course.

Thus, torsion is created. The torsional strength of a material is its resistance to twisting or torque (twisting stress).



SHERS

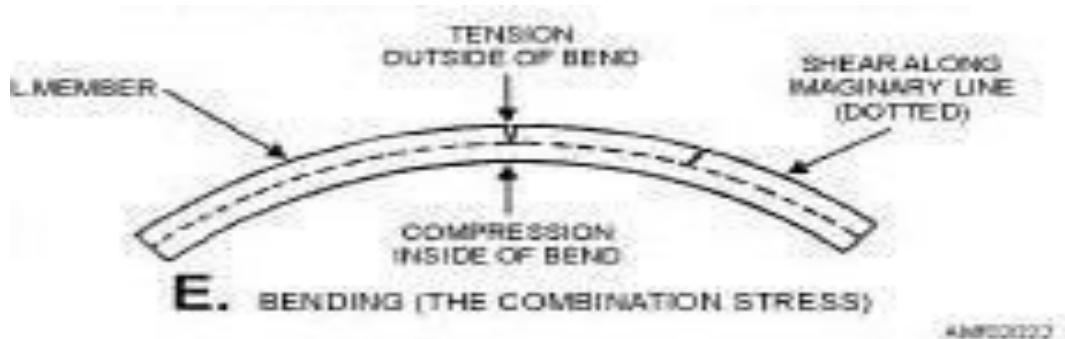
The force acting in a direction parallel to a surface or to a planar cross section of a body. For example, the pressure of air along the front of an airplane wing.



BENDING STRESSES

The Bending occurs because of the reaction of the airflow against the wings and empennage. The five stresses acting on an aircraft. Aircraft is in flight, lift forces act upward against the wings, tending to bend them upward.

For example, when bending a piece of tubing, the upper portion stretches (tension) and the lower portion crushes together (compression).

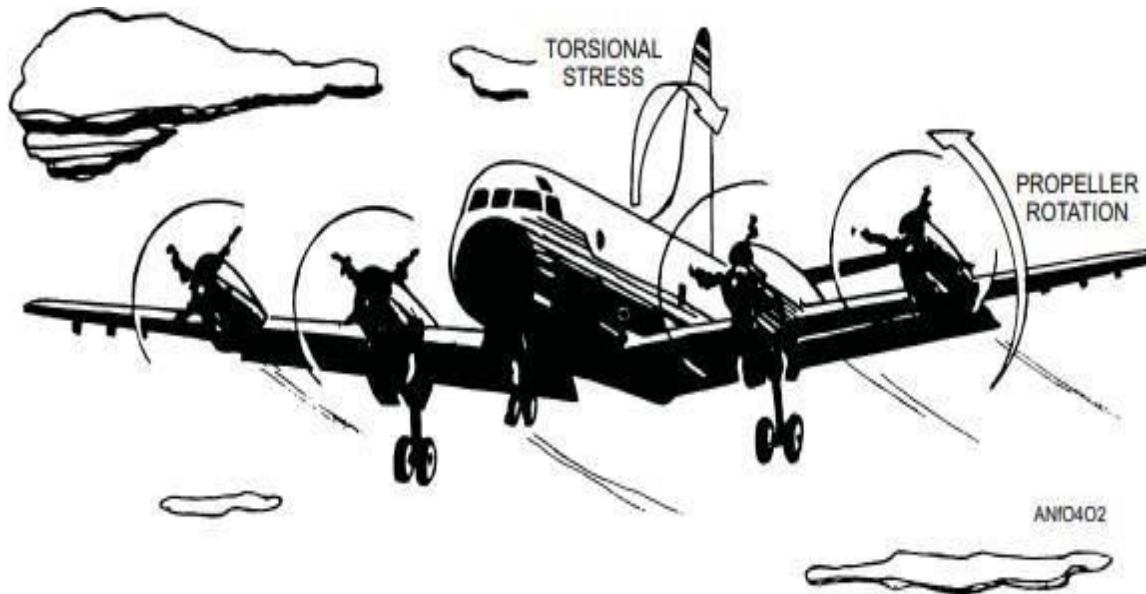


SPECIFIC ACTION OF STRESSES

You need to understand the stresses encountered on the main parts of an aircraft. A knowledge of the basic stresses on aircraft structures will help you understand why aircraft are built the way they are. The fuselage of an aircraft is subject to the five types of stress—torsion, bending, tension, shear, and compression. Torsional stress in a fuselage is created in several ways. For example, torsional stress is encountered in engine torque on turboprop aircraft. Engine torque tends to rotate the aircraft in the direction opposite to the direction the propeller is turning. This force creates a torsional stress in the fuselage. Figure 4-2 shows the effect of the rotating propellers. Also, torsional stress on the fuselage is created by the action of the ailerons when the aircraft is maneuvered. When an aircraft is on the ground, there is a bending force on the fuselage. This force occurs because of the weight of the aircraft. Bending increases when the aircraft makes a carrier landing. This bending action creates a tension stress on the lower skin of the fuselage and a compression stress on the top skin. Bending action is shown in figure 4-3. These stresses are transmitted to the fuselage when the aircraft is in flight.

Bending occurs because of the reaction of the airflow against the wings and empennage. Aircraft is in flight, lift forces

act upward against the wings, tending to bend them upward. The wings are prevented from folding over the fuselage by the resisting strength of the wing structure. The bending action creates a tension stress on the bottom of the wings and a compression stress on the top of the wings.

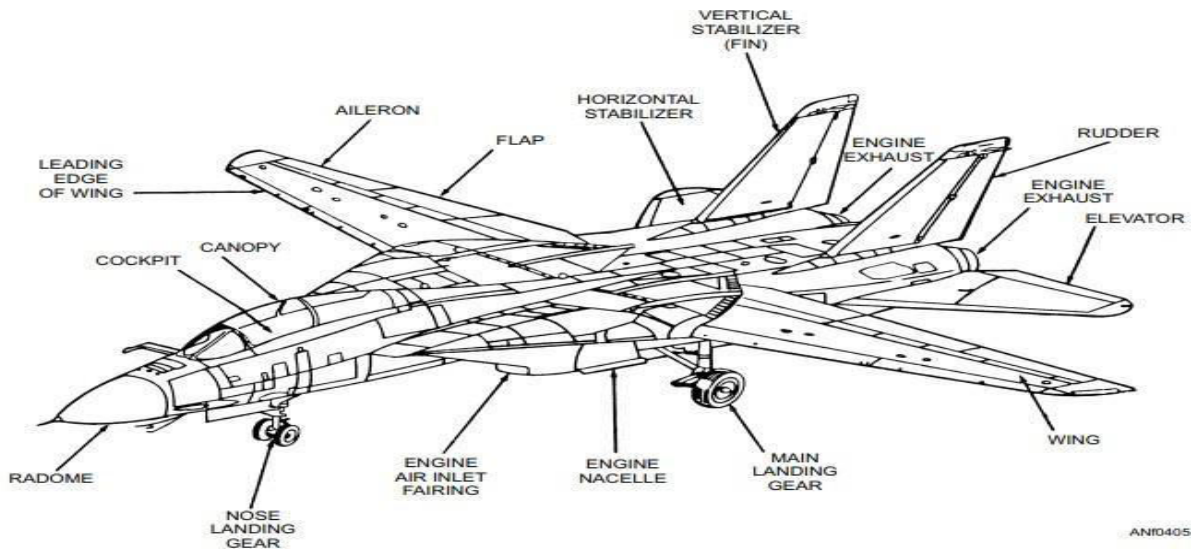


METALLIC MATERIALS

The most common metals used in aircraft construction are aluminum, magnesium, titanium, steel, and their alloys. In addition to metals, various types of plastic materials are found in aircraft construction. Some of these plastics include transparent plastic, reinforced plastic, composite, and carbon-fiber materials.

Composite and Carbon Fiber Materials

High-performance aircraft require an extra high strength-to-weight ratio material. Fabrication of composite materials satisfies this special requirement. Composite materials are constructed by using several layers of bonding materials (graphite epoxy or boron epoxy). These materials are mechanically fastened to conventional substructures. Another type of composite construction consists of thin graphite epoxy skins bonded to an aluminum honeycomb core. Carbon fiber is extremely strong, thin fiber made by heating synthetic fibers, such as rayon, until charred, and then layering in cross sections.



NOTE

The terms left or right used in relation to any of the structural units refer to the right or left hand of the pilot seated in the cockpit

FUSELAGE

The fuselage is the main structure, or body, of the aircraft. It provides space for personnel, cargo, controls, and most of the accessories. The power plant, wings, stabilizers, and landing gear are attached to it.

III. CONCLUSION

1. composites are able to withstand damage from various chemicals such as acid rain, reducing the need for repair and maintenance of parts.
2. Weight reduction is the single greatest advantage of composite material usage and is the key factor in using it in aircraft structure. Fiber-reinforced matrix systems are stronger than traditional aluminum found on most aircraft, and they provide a smooth surface and increase fuel efficiency, which is a huge benefit.
3. aerospace-grade aluminum and, more recently, composite materials such as carbon fiber.

REFERENCES

1. <https://www.sciencedirect.com/science/article/pii/S0263822322010005#!>
2. https://www.researchgate.net/publication/331332644_DESIGN_AND_ANALYSIS_OF_A_SMART_COMPOSITE_WING
3. [[https://www.ijraset.com/research-paper/structural-analysis-of-airplane-wing-using-composite-and-natural-fiber-materials: aerospace-grade aluminum and, more recently, composite materials such as carbon fiber](https://www.ijraset.com/research-paper/structural-analysis-of-airplane-wing-using-composite-and-natural-fiber-materials-aerospace-grade-aluminum-and-more-recently-composite-materials-such-as-carbon-fiber).file:///C:/Users/SANA/Downloads/TENSION%20STREES.html
4. fiber.file:///C:/Users/SANA/Downloads/TENSION%20STREES.html
5. "What are Composites". Discover Composites. Archived from the original on 2021-05-22. Retrieved 2020-12-18.
6. Nepal, Dhriti; Kang, Saewon; Adstedt, Katarina M.; Kanhaiya, Krishan; Bockstaller, Michael R.; Brinson, L.

- Catherine; Buehler, Markus J.; Coveney, Peter V.; Dayal, Kaushik; El-Awady, Jaafar A.; Henderson, Luke C.; Kaplan, David L.; Ketten, Sinan; Kotov, Nicholas A.; Schatz, George C. (2022- 11-28). "Hierarchically structured bioinspired nanocomposites". *Nature Materials*. **22** (1): 18–35. doi:10.1038/s41563-022-01384-1. ISSN 1476-1122. PMID 36446962. S2CID 254094123. Archived from the original on 2022-12-12. Retrieved 2022-12-12.
7. ^ McEvoy, M. A.; Correll, N. (19 March 2015). "Materials that couple sensing, actuation, computation, and communication". *Science*. **347** (6228): 1261689. doi:10.1126/science.1261689. PMID 25792332.
8. ^ "Autonomous Materials Will Let Future Robots Change Color And Shift Shape". popsci.com. 20 March 2015. Archived from the original on 27 September 2017. Retrieved 3 May 2018.
9. ^ "Composites | Composite Materials". Mar-Bal, Inc. 2013-10-15. Archived from the original on 2015-11-13. Retrieved 2020-12-18.
10. ^ "Applications | Composites UK". compositesuk.co.uk. Archived from the original on 2015-02-26. Retrieved 2020-12-18.
11. ^ "Achieving Class A Appearance On Fiber-Reinforced Substrates". www.coatingstech-digital.org. Archived from the original on 2021-09-20. Retrieved 2021-06-24.
12. ^ Shaffer, Gary D. (Spring 1993). "An Archaeomagnetic Study of a Wattle and Daub Building Collapse". *Journal of Field Archaeology*. **20** (1): 59–75. doi:10.2307/530354. JSTOR 530354.
13. ^ "Minerals commodity summary – cement – 2007". US United States Geological Survey. 1 June 2007. Archived from the original on 13 December 2007. Retrieved 16 January 2008.
14. ^ Jump up to:^a ^ "History of Composite Materials". Mar-Bal Incorporated. 2013-08-19. Archived from the original on 2018-01-04. Retrieved 2018-01-03



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