**Aircraft Structures Definitions**

**A**

Access panel
- removable panel for inspection or maintenance

Aft
- near of in the direction of the rear of the aircraft

Aerodynamics
- the study of how the moving body (aircraft) interacts with air flowing around it, flies

Aerodynamic centre
- the point of application for additional aerodynamic loads

Aeroelasticity
- the study how to find measures against flutter (undamped vibration in the structure due to aerodynamic loads)

Airfoil
- wing-section

Afterburner
- extra injection of fuel in extra combustion chamber between the turbine and the nozzle of the engine; creates a higher thrust

Age hardening, ageing
- strengthening at room temperature of a quenched metal alloy by very small and uniformly dispersed particles that precipitate from supersaturated solution

Ageing
- decrease of mechanical properties of polymer matrix composites or adhesives by exposure to a wet environment

Aileron
- control surface for aircraft rolling

Airframe
- main components which carry all the loads

Aisle
- passage in passenger cabin between rows of chairs

Allowable stress
- maximum stress level allowed in a structure (so that it does not deform plastically or break)

Alloy
- the combination of several metal components

Angle of attack
- the angle between the chord line of a wing or other aerodynamic surface and the oncoming air

Anhedral (negative Dihedral)
- a wing in a reverse v-form

Aspect ratio
- the ratio of wing span to average chord, an indication of the slenderness of a wing

Assembly
- building parts and components together to an aircraft

Auxiliary power unit
- system to generate electric power when the engines are not running

Auxiliary spar
- an extra beam in the root in the wing for extra strength

**B**

Beam
- a structural member loaded at an angle (often at a right angle) to its length

Bearing stress
- used for bolted or riveted joints – load/bolt diameter times material thickness

Bending moment
- the product of a force and its moment arm

Biplane
- aircraft with an upper and lower wing on top of each other

Bird strike
- an impact of a bird on the structure

Blade
- one half of a propellor

Bolt (nut)
- joining member consisting of head and stem using a nut to tighten it

Bonding or adhesive bonding
- method of joining using adhesive material (polymeric material with sufficient strength to transfer load)

Brace
- strengthening wire to support a structure, generally loaded in tension
Bracket
- small fitting or support to attach system parts

Brake
- system attached to the wheels to slow down or stop the airplane when on the ground

Buckling
- out of plane bending, followed by crushing of material under compressive loads

Bulkhead
- a panel separating areas in the structure

Cabin
- the lace in the airplane where passengers (payload) stay during the flight

Camber
- the curved line precisely between the upper and lower skin of an airfoil

Canard
- an arrangement of foreplanes and win, rather than the conventional wing and horizontal tailplane

Cantilever
- a beam supported only at the end

Centre of gravity
- point of balance of the mass of the aircraft (component)

Centre of pressure
- the centroid of the pressure distribution

Centre-line of aircraft
- line connecting geometric middle points of cross sections of the aircraft structure

Centre wingbox
- central part of the wing which is located inside, right under or right above the fuselage

Centrifugal force
- a resulting force by spinning a mass around

Clips and Cleats
- small angles or simple sheet metal parts for (shear) connection of various parts

Chord
- the distance between the leading and trailing edge of a wing section

Chord line
- an imaginary line jointing the leading and trailing edge of a wing section

Cockpit
- place where pilots fly the airplane

Composite
- containing more than one component (in particular materials containing a mixture of plastics and metal, or fibre reinforcements)

Compression
- stress or force that tends to push material together

Compressor
- part of the jet engine where the air coming from the inlet is brought to a higher pressure

Controls
- instruments to control the aircraft: change the position of the control surfaces and the propulsion

Corrosion
- attack of the material by an unwanted chemical reaction (oxidation)

Cowling
- the covers around the engine

Cruising flight, cruise
- the steady, stationary part of the flight when the airplane is not landing starting or performing a manoeuvre

Cut out
- removing of material, opening in skin or structure

D

Deflection
- change of the position of the control surface

Delta wing
- a wing in a triangular planform

Dihedral
- wing in a v-shape

Door
- a hatch for letting people or cargo in and out

Double curvature
- structures that have different curvatures in two directions of various directions
Doubler
- reinforcing sheet against the skin

Downwash
- a small air velocity component in the downward direction aft of the wing

Drag
- a resisting force as a result of the motion of body through a medium

Drain holes
- holes in the structure to remove water accumulated during flight

E
Elastic limit
- point where elastic elongation changes in plastic elongation

Elevator
- control surface for pitch

Elevons
- control surface for pitch and roll

Empennage
- the rear section of the body of the airplane with stabilisers

Engines
- the power units for propulsion of the aircraft

Extrusion
- a forming technique whereby a metal in plastic condition at elevated temperature is force, by pressure, through a orifice

F
Fail safe
- principle of maintaining adequate performance after some degree of damage or degradation has occurred

Failure
- plastic deformation or breaking of a structure

Fairing
- non-structural transition part between components to create an aerodynamic smooth shape and low drag

Fan (ducted – unducted)
- propeller (shield – unshielded)

FAR
- Federal Aviation Regulations, certification procedures and airworthiness standards of the US government (FAA)

Fasteners
- means for mechanically joining parts (bolted and riveted joints)

Fatigue
- failure, at relatively low stress levels, of structures that are subjected of fluctuating and cyclic stress

Fence
- shield

Fin
- vertical stabilizer, tailplane

Finite element method
- numerical method of calculation by discretisation a continuum into a finite number of parts (elements)

Fitting
- generally heavily loaded part or fixture to attach system or other part to a structure

Flap
- the movable part at the trailing edge of the wing which, when extended and / or deflected, increase the lift

Flaperon
- the surface which combines the control function of flaps and ailerons

Flight deck
- place where the pilots fly the airplane

Foreplane
- a horizontal stabilizing and control surface forward of the wing (see canard)

Flutter
- an oscillation caused by interaction between structural and aerodynamic effects

Floor
- lower surface of the cabin

Frame
- a hoop-shaped fuselage member which gives it its cross-sectional shape

Fuselage
- the mainbody of the aircraft, airframe without the wings and the tail
**G**

Gust
- turbulence

**H**

Hardness
- the measure of material’s resistance to deformations by surface indentation or by abrasion

Hatch
- door for inspection or maintenance

Heat treatment of metals
- treatment to improve the material properties (mechanical properties, formability, corrosion resistance)

High lift device
- device to create higher lift

Hinge
- a movable joint with one (or more) degree(s) of freedom

Honeycomb
- the core material, between face sheets of a sandwich structure, with the shape of the six sided wall shape made by the honeybee

Hooke's law
- the strain is equal to the stress divided by the Young's modulus

Hoop stress
- stress in a pipe wall acting circumferentially (in a plane perpendicular to the longitudinal axis of the pipe) and produced by the pressure of fluid or gas in the pipe

Horizontal stabilizer
- horizontal tailplane

**I**

ILS
- instrument landing system

Impact
- collision of object onto a structure

Inertia
- a body's resistance to a change in its motion as a result of an applied acceleration

Intake
- the inlet of the engine to decelerate the flow

Intercostal
- part connecting two ribs for attachment of systems

**J**

JAR
- Joint Aviation Regulations, certification procedures and airworthiness standards of the European Joint Aviation Authorities (JAA)

Joggles
- preformed flange of stringer to fit precisely and follow thickness steps in structure

Joint
- the connection between two parts

**L**

Landing gear
- the system (wheels, brakes, shock absorbers, struts, etc) on which the airplane can land

Landing loads
- the forces which are caused by landing in the landing gear and back-up structure

Leading edge
- the front of the wing or tail plane

Lift
- a force at right angles to a body’s motion through the air, generated as a result of a pressure difference between opposite surfaces

Limit load
- the high force which will be one time load the structure at which no plastic deformation should occur

Load
- the forces and moments acting on a structure

Longeron
- the main stringer in the fuselage or longitudinal beam

Lug
- ear or connecting link
Mainframe
- frame at which wing spar is connected to the fuselage

Maintenance
- to keep the plane in good condition for continued operation

Manoeuvre
- movements of the aircraft deviating from the stationary flight (e.g. rolling, banking, turning)

MIL handbook
- military handbook (USA)

Modulus
- elastic modulus (or shear modulus): resistance against deformation of a material (see also Hooke's law), ratio of stress to strain, measure for the material stiffeners

Moment arm
- the perpendicular distance from the line of action of a force to the point at which the moment acts

Monocoque
- a structure with a close cross-section which mainly consists of a thin skin

Mould
- a form in which you can cast or form a part

Mount
- to fix on a support

Nacelle
- outer casing and support structure of an aircraft engine

Notch
- sharp groove or cut in material

Nozzle
- the exhaust end of the engine where the air jet accelerates

Panel
- structural subassembly of skin and stiffening elements

Payload
- the cargo and people that have to be transported

Pitch
- rotation around the y axis of the aircraft, distance between parts (e.g. rivet pitch)

Plastic
- deformation which will not go back to the original state when the forces will be gone

Plate
- flat piece of material with thickness over 6 mm (see also sheet)

Poisson’s ratio
- the negative ratio of lateral and axial strains that results from an applied axial stress in the elastic zone of a material

Precipitation heat treatment
- hardening, by heating the quenched alloy at about 175°C for a few hours, due to very small particles that precipitate from a supersaturated solid solution

Prepreg
- continuous reinforcing fibres (UD or fabric) impregnated with uncured matrix resin to manufacture a composite part

Pressure
- force by gas or liquid acting on a solid surface, depending on flow conditions

Pressurization
- pump more air into the cabin than is allowed to escape

Primary structure
- the parts of the plane in which failure will be causing fatal danger for the passengers

Primer
- first coat of paint or diluted adhesive material

Pylon
- slender compound of structure for attachment of engines

Paint
- polymeric material used as coating for corrosion protection or for aesthetic reasons
**Redundancy**
- the provision of alternative load paths or functional routes such that the failure of the element will not cause collapse of the entire structure or total system failure

**Residual strength**
- a strength that remains in a material or part that contains a damage or crack

**Resultant of forces**
- the sum of the forces acting on a structure

**Rib**
- part of the wing structure which provides the wing-section's shape and supports the skin and stringers

**Rib cap**
- part of the rib, flange, that connects to the skin

**Rivet**
- fastener in sheet metal parts, consisting of head and stem, and after placing an upset head is formed by squeezing or hammering

**Rolling**
- rotation around the x-axis of the aircraft, due to aileron deflection; deformation of sheet material with a rolling mill in a circular cross-section

**Root**
- the end of the wing closest to the fuselage

**Rudder**
- control surface that can turn the nose of the airplane to the left and the right

**Sandwich**
- a panel which has a great stiffness by spatial shape, build up of a core material with two face sheets

**Servo actuator**
- independent power driven adjustment or shifting mechanism

**Shear / shearforce**
- a form of loading which tends to cause the atoms or molecules of a material to slide over each other, similar to the action created by a pair of scissors

**Sheet**
- flat piece of material with thickness under 6 mm (see also plate)

**Shell structure**
- structure which is build up of load bearing, thin sheet material, with stiffening elements

**Shock wave**
- an area of rapid change of air pressure created when air flows at a higher speed than the local speed of sound

**Skin**
- the sheets on the outside of the structure

**Slat**
- a control surface at the leading edge of the wing that increases wing surface area and lift when extended

**Slot**
- opening or gap in the structure

**Smart structure**
- structures that are able to sense changes in their environment and than respond to these changes in predetermined matter

**Span**
- the distance from wing-tip to wing-tip

**Spar**
- a spanwise beam in a wing which carries the majority of bending moment generated by lift, weight and inertia loads

**Spar cap**
- upper and lower part of the spar separated by a web. The bending moment in the wing is transferred via shear in the web into tension and compression forces in the caps

**Speedbrake**
- control surface to slow down the airplane

**Splice**
- joint made in assembly of aircraft components (over a manufacturing division), in which all individual parts have to be connected

**Spoiler**
- opening panels on upper surface of the wing to disturb the airflow over the wing (spoils lift), sometimes used to supply additional roll control

**Stabilizer**
- to give the aircraft stability during flight, smaller wing (fixed horizontal and vertical) are located at the tail of the plane
Stalling speed
- the lowest speed of the aircraft in flight at which the airflow over the wing separates and becomes turbulent, so the lift will be lost

Station line
- measuring line or plane giving frame position

Stiffness
- the measure of the resistance against deformation or displacement, material property (see modulus) but also structural characteristic

Strain
- the elongation divided by the original length

Strap
- strip of material used to join parts together

Strength-to-weight ratio
- the ratio of the material’s static strength to its weight, also called specific strength

Stress
- the intensity of loading, given by the applied force divided by the area over which the force acts

Stringer
- a stiffening member which supports a section of the load carrying skin, to prevent buckling under compression or shear loads

Structure
- the way several parts are connected together to fulfill a load carrying function

Strut
- a slender (bar or tubular) structural member which is loaded in compression

Stub
- short stump, structure to attach engine to fuselage

Sweep angle
- the angle between quarter chord line of the wing and centre line of fuselage, swept-back has a positive sweep angle

Tailplane
- the vertical or horizontal planes at the back of the fuselage

Tension
- effect produced by two forces pulling against each other

Thrust
- the force generated by the engine(s) making an aircraft to travel forwards, overcoming the drag force

Thrust reverser
- system of flaps or doors on the jet engine that bends the jet forward, thus slowing down the aircraft after landing

Tie
- a tension loaded part used to attach system parts

Tip
- the outermost extremity of a wing

Torsion
- moment in the cross-section

Torsion box
- combined spars and skin that create a closed box in the wing to take torsion forces

Trailing edge
- the back of the wing or tailplane structure

Trim
- balanced condition, an airplane that is flying at an angle of attack such that its moment about the centre of gravity is zero

Truss
- structure which it’s made out of tubes, rods or thin elements, each element only loaded in tension or compression

Tube
- a pipe which can take torsion, or used as strut

Turbine
- a part of the engine which extracts kinetic energy from the expanding gases coming from the combustion chamber, using this to drive the compressor

Turbulence
- gust of wind
Ultimate load
- the load which will cause failure of the structure

Undercarriage
- the system on which the airplane can land or descent (also called landing gear)

Web
- a structural member mainly loaded in shear in the plane of the member (part of the spar, and sometimes in ribs and frames)

Weight
- the mass multiplied by the gravitation

Welding
- a way of jointing two parts together by local melting

Window
- a cut-out in the structure, covered with a transparent material to look through

Windscreen, windshield
- the front window

Wing
- the plane to provide lift

Wing box
- a box in the wing to take torsion forces

Wing loading
- an aircraft's weight (or effective weight if it manoeuvring) divided by its gross wing area

Wing span
- the distance from wing-tip to wing-tip

Winglet
- the vertical aerodynamic plane at the end of the wings

Wire-braced structure
- a structure that is held together by wires

Work hardening
- the increase in hardness and strength of a ductile metal as it is plastically deformed below its recrystallization temperature

Yield point
- stress level of a loaded material where next to deformation starts to become plastic