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Terms and symbols for flight dynamics — Part 6 : Aircraft geometry

AMENDMENT 1

Termes et symboles de la mécanique du vol — Partie 6 : Géométrie de l'avion
Amendement 1

Amendment 1 to part 6 of International Standard ISO 1151-1982 was developed by Technical Committee ISO/TC 20, *Aircraft and space vehicles*. It was submitted directly to the ISO Council, in accordance with clause 6.11.2 of part 1 of the *Directives for the technical work of ISO.*

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Note 2 in 6.7.2.13

Delete the last part of the sentence, i.e. the example given in parentheses, so that the sentence reads as follows :

2 It may be useful to define the fin area by projecting the fin chord surface on some other surface that shall be specified.

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Terms and symbols for flight dynamics — Part 6 : Aircraft geometry

Termes et symboles de la mécanique du vol — Partie 6 : Géométrie de l'avion

Second edition — 1982-02-15

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1151/6 was developed by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, and was circulated to the member bodies in December 1979.

It has been approved by the member bodies of the following countries :

Austria	France	South Africa, Rep. of
Belgium	Germany, F.R.	Spain
Brazil	Italy	United Kingdom
Canada	Mexico	USA
Chile	Netherlands	USSR
China	Poland	
Czechoslovakia	Romania	

No member body expressed disapproval of the document.

This second edition cancels and replaces the first edition (i.e. ISO 1151/6-1977).

International Standard ISO 1151, *Terms and symbols for flight dynamics*, comprises, at present, six parts :

ISO 1151/1, *Terms and symbols for flight dynamics — Part 1 : Aircraft motion relative to the air.*

ISO 1151/2, *Terms and symbols for flight dynamics — Part 2 : Motions of the aircraft and the atmosphere relative to the Earth.*

ISO 1151/3, *Terms and symbols for flight dynamics — Part 3 : Derivatives of forces, moments and their coefficients.*

ISO 1151/4, *Terms and symbols for flight dynamics — Part 4 : Parameters used in the study of aircraft stability and control.*

ISO 1151/5, *Terms and symbols for flight dynamics — Part 5 : Quantities used in measurements.*

ISO 1151/6, *Terms and symbols for flight dynamics — Part 6 : Aircraft geometry.*

This International Standard is intended to introduce the main concepts, to include the more important terms used in theoretical and experimental studies and, as far as possible, to give corresponding symbols.

In this International Standard, the term "aircraft" denotes a vehicle intended for atmosphere or space flight. Usually, it has an essentially port and starboard symmetry with respect to a plane. That plane is determined by the geometric characteristics of the aircraft. In that plane, two orthogonal directions are defined : force-and-aft and dorsal-ventral. The transverse direction, on the perpendicular to that plane follows.

When there is more than one plane of symmetry, or when there is none, it is necessary to introduce a reference plane. In the former case, the reference plane is one of the planes of symmetry. In the latter case, the reference plane is arbitrary. In all cases, it is necessary to specify the choice made.

Angles of rotation, angular velocities and moments about any axis are positive clockwise when viewed in the positive direction of that axis.

All the axis systems used are three-dimensional, orthogonal and right-handed, which implies that a positive rotation through $\pi/2$ around the x-axis brings the y-axis into the position previously occupied by the z-axis.

Numbering of sections and clauses

With the aim of easing the indication of references from a section or a clause, a decimal numbering system has been adopted such that the first figure is the number of the part of the International Standard considered.

Contents

Terms and symbols for flight dynamics — Part 6 : Aircraft geometry

6.0 Introduction

6.0.1 This International Standard defines certain notions used for the geometric description of an aircraft for the purpose of flight dynamic studies[1].

It does not give all the definitions that permit the detailed description of the shape of the aircraft.

6.0.2 The aircraft is considered to be made up of various components. These components are in practice grouped in sub-sets forming the "main parts" of the aircraft.

A main part consists of a basic component and usually some other components that are either fixed or movable. The positions of movable components with respect to the basic component can be varied during flight.

Examples

Components \ Main parts	Fuselage	Wing	Tailplane	. . .
Basic components	Cabin	Centre section	Fixed surface	. . .
Fixed components	Tail cone	Fixed portions	—	. . .
Movable components	Droop nose Landing gear doors	Variable sweep portions Flaps Ailerons Slats	Pitch motivator Tab	. . .

Moreover, the position of a main part with respect to another main part can be varied in flight. Examples : The rotation of the tailplane with respect to the fuselage, the rotation of the engine nacelles of a vertical take-off and landing aircraft with respect to the wing.

The breakdown of the aircraft into main parts and components depends on the problem studied. For example, a high-lift system composed of several flaps can be considered as a single component if the law of relative motion of the various flaps is defined (for example, during the study of approach at different deflections); in that case, the position of the component is defined by a single parameter which is the position of the high-lift system control. On the other hand, under other circumstances, each flap must be considered as a component (for example, during a wind-tunnel study aimed at defining the law of relative motion of the various flaps).

6.0.3 The basic component is used to define the relative positions of the other components composing the main part to which it belongs by means of reference axis systems within each component (6.1.9). The basic component is equally used to define the relative position of the main part to which it belongs with respect to the other main parts by means of reference axis systems within each main part (6.1.13).

To define the position of each main part with respect to the aircraft, it is necessary to define an axis system $x_R y_R z_R$, called the aircraft reference axis system (6.1.4).

That axis system need not be the body axis system (1.1.5) the axes of which are chosen from flight dynamic considerations. Usually, the axes of the aircraft reference axis system are coincident with the axes of the fuselage axis system.

1) The definitions introduced in this International Standard have been worded to maintain consistency with other fields (study of structures, manufacturing, etc.) in which it may also be necessary to introduce further concepts.

6.0.4 For the basic component of the fuselage, the terms "forward", "starboard" and "ventral" have their generally accepted meanings.

The forward, starboard and ventral directions for any component follow from its general orientation with respect to the fuselage.

It is emphasised that the terms "forward", "starboard" and "ventral" are a necessary part of the definition of each component, but do not refer to the direction of motion of the aircraft, to its position with respect to the Earth, or to the position of the pilot in the aircraft. Thus the forward direction of the fuselage of a vertical take-off and landing aircraft remains the same irrespective of the direction in which the aircraft is flying.

On the basis of these conventions the axis system fixed in each component, called the "reference axis system" (6.1.9), would usually be oriented with the x-axis in the forward direction, the y-axis to starboard and the z-axis in the ventral direction.

6.0.5 A reference point (6.1.7), an axis (6.1.8) and an axis system (6.1.9) for each component can be determined from datum points and lines marked on the aircraft or on drawings.

The complete definition of the geometric shape of each component must be given with respect to its reference axis system (6.1.9).

6.0.6 It is assumed possible to extract from the set of components a sub-set that constitutes the major part of the aircraft in which the individual components are either symmetrical, or are symmetrically disposed, in the port and starboard sense with respect to a plane which is called the aircraft reference plane (6.1.1).

6.0.7 In order to describe a component or a main part, it may be convenient to introduce one or more overall parameters representative of the shape of the component or the main part (example : the maximum cross-sectional area and the length of the fuselage). The relative positions of different components or different main parts depend on the action of the pilot or of certain systems and of the inertial and aerodynamic load state. These relative positions define the geometric state of the aircraft (6.1.17).

6.0.8 If, in the course of a flight dynamic study, certain geometrical quantities vary (for example, the span and wing area of a variable-sweep aircraft), it is recommended that one of the possible values of each of these geometric quantities should be chosen as the reference quantity.

6.0.9 The reference surface and reference length used for the calculation of non-dimensional coefficients are defined in part 1, respectively in 1.4.5 and 1.4.6.

6.1 General characteristics

No.	Term	Definition	Symbol
6.1.1	Aircraft reference plane	The plane with respect to which a sub-set of the components that constitutes the major part of the aircraft is symmetrically disposed in the port and starboard sense. This plane is the $z_R x_R$ plane of the aircraft reference axis system (6.1.4) NOTE — In the most frequent case, the aircraft reference plane is coincident with the fuselage reference plane (6.4.3).	$z_R x_R$
6.1.2	Aircraft reference point	A suitably chosen point fixed in the aircraft reference plane (6.1.1).	—
6.1.3	Aircraft reference axis	A suitably chosen straight line fixed in the aircraft reference plane (6.1.1) passing through the aircraft reference point (6.1.2) and in the forward direction.	x_R
6.1.4	Aircraft reference axis system	A right-handed orthogonal axis system fixed in the aircraft with origin at the aircraft reference point (6.1.2), with x-axis coincident with the aircraft reference axis (6.1.3) and with the z_R-axis in the aircraft reference plane (6.1.1). The y_R-axis completes the axis system and is to starboard. NOTE — In the most frequent case, the aircraft reference axis system coincides with the fuselage axis system (6.4.1).	$x_R y_R z_R$
6.1.5	Setting of the body axis system with respect to the aircraft reference axis system	The set of geometric quantities (in general three co-ordinates and three orientation angles) that defines the position of the body axis system (1.1.5) with respect to the aircraft reference axis system (6.1.4).	—
6.1.6	Setting angle of the longitudinal axis with respect to the aircraft reference axis	The angle through which the aircraft reference axis (6.1.3) must be turned about the y_R-axis of the aircraft reference axis system (6.1.4) to bring it parallel to the longitudinal axis (1.1.5) in the special case where the transverse axis (1.1.5) is parallel to the y_R-axis. The angle is positive when the rotation is made in the positive sense of rotations in the aircraft reference plane (6.1.1).	—

No.	Term	Definition	Symbol
6.1.7	Reference point (of a component)	A suitably chosen point fixed in the component.	—
6.1.8	Reference axis (of a component)	A straight line fixed in the component passing through the reference point (6.1.7) and in a suitably chosen direction.	—
6.1.9	Reference axis system (of a component)	A right-handed orthogonal axis system, fixed in the component, with origin at the reference point (6.1.7), made up of three reference axes (6.1.8) usually chosen in the following manner : the x_i-axis is directed forward; the y_i-axis is to starboard; the z_i-axis completes the system.	$x_i y_i z_i$ x_i y_i z_i NOTE — The subscript i is a number or letter that denotes the component considered.
6.1.10	Setting of one component with respect to another component	The set of geometric quantities (in general three co-ordinates and three orientation angles) that defines the position of the reference axis system of a component (6.1.9) with respect to the reference axis system of another component.	—
6.1.11	Reference point of a main part	The reference point (6.1.7) of the basic component of a main part (6.0.2).	—
6.1.12	Reference axis of a main part	The reference axis (6.1.8) of the basic component of a main part (6.0.2).	—
6.1.13	Reference axis system of a main part	The reference axis system (6.1.9) of the basic component of a main part (6.0.2).	—
6.1.14	Setting of a main part with respect to another main part	The set of geometric quantities (in general three co-ordinates and three orientation angles) that defines the position of the reference axis system of a main part (6.1.13) with respect to the reference axis system of another main part.	—
6.1.15	Setting of a main part with respect to the aircraft reference axis system	The set of geometric quantities (in general three co-ordinates and three orientation angles) that defines the position of the reference axis system of a main part (6.1.13) with respect to the aircraft reference axis system (6.1.4).	—
6.1.16	Geometric state of a main part	The set of quantities characterizing the relative positions of the various components of a main part.	—
6.1.17	Geometric state of the aircraft	The set of quantities characterizing the relative positions of the various main parts.	—

The co-ordinates of a point P in the reference axis system $x_i y_i z_i$ are designated by x_{iP}, y_{iP} and z_{iP}. The index i is a numerical or literal index that indicates the reference axis system. The index P is a numerical or literal index that indicates the given point P.

The relative position of a point P (x_{iP}, y_{iP}, z_{iP}) with respect to a point Q (x_{iQ}, y_{iQ}, z_{iQ}) is defined by the differences between the co-ordinates of these points with respect to the reference axis system $x_i y_i z_i$.

NOTE — The index i may be omitted if there is no danger of confusion.

No.	Term	Definition	Symbol
6.1.18	—	The difference between the x co-ordinates of the point Q and of the point P in the chosen reference axis system. $x_{iPQ} = x_{iQ} - x_{iP}$	x_{iPQ}
6.1.19	—	The difference between the y co-ordinates of the point Q and of the point P in the chosen reference axis system. $y_{iPQ} = y_{iQ} - y_{iP}$	y_{iPQ}
6.1.20	—	The difference between the z co-ordinates of the point Q and of the point P in the chosen reference axis system. $z_{iPQ} = z_{iQ} - z_{iP}$	z_{iPQ}

6.2 Overall dimensions of the aircraft

For a given geometric state of the aircraft (6.1.17), overall dimensions of the aircraft are defined as follows.

No.	Term	Definition	Symbol
6.2.1	Overall length (of the aircraft)	The distance between the two planes parallel to the $y_R z_R$ plane of the aircraft reference axis system (6.1.4), just touching the surface of the aircraft and lying wholly outside it.	l_R
6.2.2	Overall width (of the aircraft)	The distance between the two planes parallel to the aircraft reference plane (6.1.1), just touching the surface of the aircraft and lying wholly outside it.	b_R
6.2.3	Overall height (of the aircraft)	The distance between the two planes parallel to the $x_R y_R$ plane of the aircraft reference axis system (6.1.4), just touching the surface of the aircraft and lying wholly outside it.	h_R

For a given geometric state of the aircraft (6.1.17), corresponding overall dimensions are defined for the aircraft resting on a horizontal ground plane with the y_R-axis of the aircraft reference axis system (6.1.4) parallel to that plane.

No.	Term	Definition	Symbol
6.2.4	Ground overall length (of the aircraft)	The distance between the two planes perpendicular to the ground plane, parallel to the y_R-axis of the aircraft reference axis system (6.1.4), just touching the surface of the aircraft and lying wholly outside it.	l_o
6.2.5	Ground overall width (of the aircraft)	The distance between the two planes perpendicular to the ground plane, parallel to the x_R-axis of the aircraft reference axis system (6.1.4), just touching the surface of the aircraft and lying wholly outside it. NOTE — For the same geometric state of the aircraft (6.1.17), the quantities defined in 6.2.2 and 6.2.5 are identical.	b_o
6.2.6	Ground overall height (of the aircraft)	The distance between the ground plane and the plane parallel to that plane, just touching the surface of the aircraft and lying wholly outside it.	h_o

6.3 Ground limit angles

Ground limit angles represent the extreme angular positions that the aircraft may assume on the ground plane. These angles depend on the geometric state of the aircraft (6.1.17) taking into account the mass distribution, the undercarriage and the tyre distortion, etc.

In order to represent the extreme angular positions that the aircraft may assume at lift-off and touch-down, the limit angles are defined only when no reaction forces are exerted at the various contact points and when inertia forces are zero, in which case, the undercarriage is in the position resulting from the action of its own weight only.

In these extreme angular positions, at least two points of the aircraft structure are in contact with the ground plane.

NOTE — Other ground limit angles can be defined in an analogous manner when the ground reaction forces are not zero.

No.	Term	Definition	Symbol
6.3.1	Ground limit angle in pitch	The absolute value of the angle between the aircraft reference axis (6.1.3) and the ground plane when the aircraft main undercarriage and that part of the aircraft lying aft of the main undercarriage are just in contact with the ground plane with no reaction forces and with the y_R-axis parallel to the ground plane. NOTE — An analogous angle may be defined in the nose-down sense, but is less likely to arise as a result of intentional action.	—

No.	Term	Definition	Symbol
6.3.2	Ground limit angle in roll	The absolute value of the angle between the y_R-axis of the aircraft reference axis system (6.1.4) and the ground plane when : — either the outboard starboard wheel(s) of the main undercarriage and that part of the aircraft lying outboard of the starboard wheel(s), — or the outboard port wheel(s) of the main undercarriage and that part of the aircraft lying outboard of the port wheel(s), are just in contact with the ground plane with no reaction forces and with the aircraft reference axis (6.1.3) parallel to the ground plane. NOTES 1 The values of port and starboard ground limit angles are the same, unless the aircraft is not symmetrical. 2 The concept of the ground limit angle in roll may be generalized to cases in which the x_R-axis need not be parallel to the ground plane.	—

6.4 Fuselage

The main part designated "FUSELAGE" is defined by listing the various components that constitute it and specifying the basic component.

In such a listing it is necessary to indicate whether certain ancillary components disposed on the fuselage (nose probe, braking parachute housing, air intakes, etc.) are considered part of the fuselage.

For example, in the case of an aircraft incorporating a cabin and twin booms, the fuselage may be defined, depending on the problem treated, as being made up of :

— either the cabin (the basic component) alone, without the twin booms and without the nose probe;

— or the cabin (the basic component) with the twin booms and with the nose probe.

No.	Term	Definition	Symbol
6.4.1	Fuselage axis system	The reference axis system of the basic component (6.1.13) of the fuselage. NOTES 1 If the fuselage has a plane of symmetry parallel to the aircraft reference plane (6.1.1), the x_F- and z_F-axes are in that plane of symmetry. 2 If the fuselage has two fore and aft planes of symmetry and if one of them is parallel to the aircraft reference plane (6.1.1), the x_F-axis is the line of intersection of those planes of symmetry and the z_F-axis is parallel to the aircraft reference plane (6.1.1). In particular, if the fuselage is a body of revolution, the x_F-axis is the axis of revolution. 3 In the most frequent case, the fuselage axis system coincides with the aircraft reference axis system (6.1.4).	$x_F y_F z_F$
6.4.2	Fuselage axis	The x_F-axis of the fuselage axis system (6.4.1).	x_F
6.4.3	Fuselage reference plane	The $z_F x_F$-plane of the fuselage axis system (6.4.1).	$z_F x_F$
6.4.4	Fuselage setting	The setting (6.1.15) of the fuselage axis system (6.4.1) with respect to the aircraft reference axis system (6.1.4). NOTE — In the most frequent case the fuselage axis system (6.4.1) is coincident with the aircraft reference axis system (6.1.4) and the six quantities defining the setting are then all zero.	—

No.	Term	Definition	Symbol
6.4.5	Fuselage reference angle	The angle through which the x_R-axis of the aircraft reference axis system (6.1.4) must be rotated about the y_R-axis to bring it parallel to the fuselage axis (6.4.2) in the special case where the y_F-axis of the fuselage axis system (6.4.1) is parallel to the y_R-axis. This angle is positive when the rotation is made in the positive sense of rotation in the aircraft reference plane (6.1.1). NOTES 1 In this case, the fuselage setting (6.4.4) is reduced to the fuselage reference angle and three co-ordinates. 2 In the most frequent case the fuselage axis system (6.4.1) is coincident with the aircraft reference axis system (6.1.4) and the fuselage reference angle is then zero.	—

The following definitions apply to one given geometric state of the aircraft (6.1.17) (position of droop nose, position of bomb-bay doors, position of undercarriage, etc.).

No.	Term	Definition	Symbol
6.4.6	Fuselage length	The distance between the two planes perpendicular to the fuselage axis (6.4.2) just touching the surface of the fuselage and lying wholly outside it.	l_F
6.4.7	Fuselage maximum cross-sectional area	The area of the largest of the fuselage sections obtained by cutting the fuselage with planes perpendicular to the fuselage axis (6.4.2).	A_F
6.4.8	Fuselage equivalent diameter	The diameter of the circle the area of which is equal to the fuselage maximum cross-sectional area (6.4.7).	d_F
6.4.9	Fuselage fineness ratio	The ratio of the fuselage length (6.4.6) to the fuselage equivalent diameter (6.4.8). Equal to l_F/d_F.	—

6.5 Aerodynamic surfaces — General

The "aerodynamic surfaces" are main parts (6.0.2) of which one of the three dimensions is small in comparison with the other two. They are intended, in general, to create aerodynamic forces having a component, aligned with the small dimension, that is much greater than the other components.

Examples of these aerodynamic surfaces are

- the wing,
- the tailplane,
- the fin,
- the V-tail,
- the canard,
- the moustache,
- etc.

For the purpose of defining certain geometric properties associated with a given geometric state (6.1.16) of an aerodynamic surface, the latter is represented by a surface called "chord surface" (see 6.6.15 and 6.7.2.12) :

- bounded by a closed external contour,
- generated by segments of straight lines parallel to a plane, and whose extremities are situated on the contour (local chord lines, see 6.6.5 and 6.7.2.7).

The general conditions for the definition of that contour are given in 6.6 c).

Where the aerodynamic surface is interrupted by an internal duct that contains an engine component (for example : fan-in-wing or ducted propeller in a fin), it may be felt useful to consider on the chord surface an internal contour, i.e. the intersection of the internal duct and the chord surface.

The definitions of the geometric characteristics of wings are given in 6.6. They are readily adaptable to other surfaces. Clause 6.7 deals with empennages.

6.6 Wing

a) The main part designated "wing" must be defined by listing the various components that constitute it and specifying the basic component. In such a listing, it is necessary to indicate whether certain ancillary components disposed on the wing (for example : fillets, boundary layer fences, probes, antennae) or components that are normally portions of the other main parts (for example : engine nacelles, fuel tanks) are considered part of the wing.

In the case where the aircraft has several wings, several main parts are defined (for example : "upper wing" and "lower wing" or "fore wing" and "aft wing").

b) The definitions relate to a given geometric state (6.1.16) of the wing, for which the relative positions of the various movable components that constitute it (for example : flaps, slats, controls) are fixed and specified. These definitions are usually used only for particular geometric states corresponding to the retracted positions of flaps and leading-edge slats, and to the neutral positions of control surfaces.

If in the course of a flight dynamics study, several geometric states of the wing are considered and if, in consequence, geometric quantities used as reference quantities (1.4.5 and 1.4.6) (for example : wing span, wing area of a variable sweep aircraft) vary, one of these states should be chosen as reference geometric state. The values of geometric quantities, for that reference state, are then the reference quantities for all geometric states studied.

c) The external contour (6.5) of the wing, for a given geometric state, includes lines traced on the surface of the wing, called :

"leading-edge line"
and "trailing-edge line".

The definitions of these lines, not specified in this International Standard, follow from geometric and aerodynamic considerations. They must meet the conditions that follow.

In the case where the leading-edge and trailing-edge lines meet at one point at each wing tip, that point is termed the "tip point". When planes parallel to the aircraft reference plane, just in contact with the surface of the aircraft and wholly outside it, are also in contact with the wing surface, those points of contact are the tip points.

In the case where the leading-edge line and the trailing-edge line do not meet at the wing tips, the contour is completed, at each tip, by a suitably chosen segment of a straight line, termed "tip chord line", in a plane parallel to the aircraft reference plane.

The tip points or tip chord lines separate the leading-edge line from the trailing-edge line.

If the leading-edge and trailing-edge lines are interrupted by components that are not part of the wing (for example : fuselage, engine nacelles) or by gaps, the contour is completed by joining the points of interruption of those lines according to some method to be specified.

Figure 1 represents the projections of the contour on the planes of the aircraft reference axis system (6.1.4).

d) The calculation of the aircraft aerodynamic characteristics may be facilitated by the introduction of some simplified contours whose leading-edge and trailing-edge lines do not coincide at all points with the wing surface (for example, in the form of a simplified plan form).

e) Different axis systems are introduced for the description of the geometric characteristics relating to the wing.

The reference axis system of the wing, termed wing axis system (6.6.2), is used to describe the geometric state of the main part "wing" (6.1.16), including the description of the contour.

The basic axis system of the wing (6.6.11) is used to define the geometric parameters concerning the aerodynamic characteristics of the wing.

The aircraft reference axis system (6.1.4) is used in the definition of the chord lines (6.6.5 and 6.6.7), of the basic axis system (6.6.11), of the local sweep angle (6.6.22) and of the local dihedral angle (6.6.24), as these concepts relate to the wings as part of the complete aircraft.

In studies of an isolated wing, these definitions may be established with respect to the wing axis system (6.6.2) or with respect to another suitably chosen axis system (for example, in the study of an isolated oblique wing, the axis system chosen will be such that its zx-plane is parallel to the velocity at upstream infinity).

f) The definitions that follow can in some cases be simplified; for example for a trapezoidal wing, that is a wing made up of two trapezoidal plane half wings symmetrical with respect to the aircraft reference plane (6.1.1). Such simplifications will be noted in the appropriate items.

g) If, in applying the procedure set out in 6.6 c), the wing contour has been completed through the interior of the fuselage, the resulting contour is that of the "gross wing". The following definitions apply to that gross wing.

The "net wing" is obtained by excluding that part of the gross wing which by convention lies in the interior of the fuselage, that is the part contained between two root chord lines parallel to the aircraft reference plane.

h) The symbols relating to the wing are indicated by the subscript L.

No.	Term	Definition	Symbol
6.6.1	(Reference) Plane of symmetry of the wing	The plane with respect to which a sub-set of components, including the wing basic component, and constituting the major portion of the wing, is disposed symmetrically to port and to starboard. That plane is the $z_L x_L$-plane of the wing axis system (6.6.2). NOTES 1 Usually, the $z_L x_L$-plane of the wing axis system is coincident with the aircraft reference plane (6.1.1) which is usually also the fuselage reference plane (6.4.3). 2 The wing contour is usually symmetrical with respect to the $z_L x_L$-plane.	$z_L x_L$
6.6.2	Wing axis system	Reference axis system of the basic component (6.1.13) of the wing. The direction of the x_L-axis and its origin are chosen as appropriate. NOTE — It is preferable for the x_L-axis to pass through the points of intersection of the contour with the (reference) plane of symmetry of the wing (6.6.1).	$x_L y_L z_L$
6.6.3	Wing setting	Setting (6.1.15) of the wing axis system (6.6.2) with respect to the aircraft reference axis system (6.1.4).	
6.6.4	Wing span	Distance between the two planes parallel to the aircraft reference plane (6.1.1) just in contact with the wing contour [6.6 c)] and lying wholly outside it.	b
6.6.5	(Wing) Local chord line	Segment of the straight line joining the points of intersection of the leading-edge and trailing-edge lines of the wing contour [6.6 c)] with a plane parallel to the aircraft reference plane (6.1.1) and located at the coordinate y (see figures 1 and 2).	
6.6.6	(Wing) Local chord	Length of the local chord line (6.6.5).	c or l_i NOTE — The suffix i is a number or letter that may be omitted if there is no possibility of confusion with the reference length (1.4.6).
6.6.7	(Wing) Central chord line	Local chord line (6.6.5) in the aircraft reference plane (6.1.1) (see figures 1 and 2).	
6.6.8	(Wing) Centre-line chord	Length of the central chord line (6.6.7).	

No.	Term	Definition	Symbol
6.6.9	Angular position of the (wing) central chord line	Angle through which the x_R-axis of the aircraft reference axis system (6.1.4) must be turned about the y_R-axis to bring it parallel to the central chord line (6.6.7) (see figure 2). That angle is positive when the rotation is made in the positive sense.	
6.6.10	Basic plane (of the wing)	Plane perpendicular to the aircraft reference plane (6.1.1) and containing the central chord line (6.6.7) (see figures 2 and 3). NOTE — This plane is the $x_b y_b$-plane of the basic axis system (6.6.11).	
6.6.11	Basic axis system (of the wing)	Right-handed orthogonal axis system, whose origin is at the foremost point of the central chord line (6.6.7), and consisting of the following three axes (see figure 2) : — the x_b-axis contains the central chord line and is directed forwards; — the y_b-axis lies in the basic plane (6.6.10) and is parallel to the y_R-axis of the aircraft reference axis system (6.1.4); — the z_b-axis completes the axis system.	$x_b y_b z_b$
6.6.12	(Wing) Taper ratio	Ratio of the tip chord [6.6 c)] to the centre-line chord (6.6.8). NOTE — In cases where the leading-edge and trailing-edge lines meet at a point on a curved wing tip, but are essentially straight away from the tip region, a taper ratio may be defined by introducing a suitably chosen tip chord.	
6.6.13	(Wing) *n* % chord point	Point on a local chord line (6.6.5) that is situated at a distance behind the leading edge equal to *n* % of the local chord (6.6.6).	
6.6.14	(Wing) *n* % chord line	Locus of the *n* % chord points (6.6.13) (see figure 1). NOTES 1 The 0 % chord line is the leading-edge line. The 100 % chord line is the trailing-edge line. 2 In the case of a trapezoidal wing [6.6. f)], all the *n* % chord lines are straight.	
6.6.15	(Wing) Chord surface	Surface, generally twisted, formed by the local chord lines (6.6.5) (see figure 2). NOTE — In the case of a trapezoidal wing [6.6 f)], the chord surface consists of two half planes symmetrical with respect to the aircraft reference plane (6.1.1).	
6.6.16	(Wing) Area	Area of the projection of the chord surface (6.6.15) on the basic plane (6.6.10). $S_L = \int_{y_1}^{y_2} c'(y) \times dy$ where $c'(y)$ is the length of the projection of the local chord line (6.6.5) on the basic plane; y is the coordinate of the local chord line along the y_b-axis of the basic axis system (6.6.11); y_1 is the coordinate along the y_b-axis of the port tip point or port tip chord line [6.6 c)]; y_2 is the coordinate along the y_b-axis of the starboard tip point or starboard tip chord line. NOTES 1 $(y_2 - y_1)$ is equal to the wing span (6.6.4). 2 An analogous definition can be given based on the local chord lines instead of their projections.	S_L NOTE — The suffix L can be omitted if there is no possibility of confusion.

No.	Term	Definition	Symbol
6.6.17	(Wing) Aerodynamic mean chord length	Length defined by relationship : $$c_{aL} = \frac{\int_{y_1}^{y_2} [c'(y)]^2 \times dy}{\int_{y_1}^{y_2} c'(y) \times dy}$$ where $c'(y)$ is the length of the projection of the local chord line (6.6.5) on the basic plane (6.6.10); y is the coordinate of the local chord line along the y_b-axis of the basic axis system (6.6.11); y_1 is the coordinate along the y_b-axis of the port tip point or port tip chord line [6.6 c)]; y_2 is the coordinate along the y_b-axis of the starboard tip point or starboard tip chord line. NOTES 1 $(y_2 - y_1)$ is equal to the wing span (6.6.4). 2 The integral that appears in the denominator is equal to the (wing) area (6.6.16). 3 An analogous definition can be given based on the local chord lines instead of their projections.	c_{aL} or l_{aL} NOTE — The suffix L can be omitted if there is no possibility of confusion.
6.6.18	(Wing) Aerodynamic mean chord line	Segment of the straight line containing the central chord line (6.6.7). Its foremost point is at the position defined by 6.6.19 and its length is equal to the length defined in 6.6.17.	
6.6.19	Coordinate of the foremost point of the aerodynamic mean chord line (of the wing)	Coordinate along the x_b-axis of the basic axis system (6.6.11) of the foremost point of the aerodynamic mean chord line (6.6.18) having the following value : $$x_{aL} = \frac{\int_{y_1}^{y_2} c'(y) \times x(y) \times dy}{\int_{y_1}^{y_2} c'(y) \times dy}$$ where $c'(y)$ is the length of the projection of the local chord line (6.6.5) on the basic plane (6.6.10); $x(y)$ and y are the coordinates along the x_b- and y_b-axes of the foremost point of the local chord line; y_1 is the coordinate along the y_b-axis of the port tip point or port tip chord line [6.6 c)]; y_2 is the coordinate along the y_b-axis of the starboard tip point or starboard tip chord line. NOTES 1 $(y_2 - y_1)$ is equal to the wing span (6.6.4). 2 The integral that appears in the denominator is equal to the (wing) area (6.6.16). 3 An analagous definition can be given based on the local chord lines instead of their projections.	x_{aL} NOTE — The suffix L may be omitted if there is no possibility of confusion.
6.6.20	Wing aspect ratio	Ratio b^2/S_L of the square of the wing span (6.6.4) to the wing area (6.6.16).	λ, A or Λ

No.	Term	Definition	Symbol
6.6.21	Local geometric twist angle (of the wing)	Angle through which the central chord line (6.6.7) must be turned about the y_b-axis of the basic axis system (of the wing) (6.6.11) to bring it parallel to the local chord line (6.6.5) (see figure 3). This angle is positive when the rotation is made in the positive sense.	
6.6.22	Local sweep angle (of the wing)[1]	The angle, at a point P on the chord surface (6.6.15), between : the plane, passing through P, parallel to the $y_R z_R$-plane of the aircraft reference axis system (6.1.4), and, the projection on the plane passing through P, parallel to the $x_R y_R$-plane, of the tangent at P to the n % chord line (6.6.14) passing through this point (see figure 4), This angle is positive if the point T, where the tangent at P and the $z_R x_R$-plane intersect, is in front of the point P. NOTES 1 In the case where the above definitions (values and signs) are not applicable (for example, discontinuity, central chord line), sweep angles to starboard and to port of the point P will be defined conventionally as being those at points infinitesimally close to P, to starboard and to port, on the n % chord line. 2 An analogous definition can be given for a "basic local sweep angle" by replacing the planes of the aircraft reference axis system by the corresponding planes of the basic axis system (6.6.11) (see figure 5). 3 In the case of a trapezoidal wing [6.6 f)], the local sweep angle is constant along an n % chord line. 4 The local sweep angle of one or more n % chord lines appears on the plan view of a three-view drawing of the aircraft	φ
6.6.23	Local effective sweep angle (of the wing)	The angle, at a point P on the chord surface (6.6.15), between : the plane passing through P, perpendicular to the local chord line (6.6.5), and, the tangent at P to the n % chord line (6.6.14) passing through this point (see figure 6). That angle is positive if the point T, where the tangent at P intersects the $z_R x_R$-plane of the aircraft reference axis system (6.1.4), is in front of the point P. NOTES 1 In the case where the above definitions (values and signs) are not applicable (for example, discontinuity, central chord line), sweep angles to starboard and to port of the point P will be defined conventionally as being those at points infinitesimally close to P, to starboard and to port, on the n % chord line. 2 An analogous definition can be given for a "basic local effective sweep angle" by replacing the plane perpendicular to the local chord line by a plane perpendicular to the central chord line. 3 In the case of a trapezoidal wing [6.6 f)], the local effective sweep angle is constant along an n % chord line.	φ_e
6.6.24	Local dihedral angle (of the wing)	The angle, at a point P on the chord surface (6.6.15), between : the plane passing through P, parallel to the $x_R y_R$-plane of the aircraft reference axis system (6.1.4), and, the projection on the plane passing through P, parallel to the $y_R z_R$-plane, of the tangent at P to the n % chord line (6.6.14) passing through this point (see figure 7). This angle is positive if the point T, where the tangent at P intersects the $z_R x_R$-plane, is below the point P. NOTES 1 In the case where the above definitions (values and signs) are not applicable (for example, discontinuity, central chord line), dihedral angles to starboard and to port of the point P will be defined conventionally as being those at points infinitesimally close to P, to starboard and to port, on the n % chord line. 2 An analogous definition can be given for a "basic local dihedral angle" by replacing the planes of the aircraft reference axis system by the corresponding planes of the basic axis system (6.6.11) (see figure 8). 3 In the case of a trapezoidal wing [6.6 f)], the local dihedral angle is constant at all points on the wing.	υ

1) In some countries, the local sweep angle (of the wing) is termed "local projected sweep angle (of the wing)".

No.	Term	Definition	Symbol
6.6.25	Local effective dihedral angle (of the wing)	The angle, at a point P on the chord surface (6.6.15), between : the plane π containing the local chord line (6.6.5) passing through P, parallel to the y_R-axis of the aircraft reference axis system (6.1.4), and, the projection on the plane passing through P, and perpendicular to the local chord line, of the tangent at P to the n % chord line (6.6.14) (see figure 9). This angle is positive if the line of intersection of the tangent plane at P with the $z_R x_R$-plane is below the plane π. NOTES 1 The tangent plane at P contains the local chord line and the tangent to the n % chord line (6.6.14) passing through P. 2 In the case where the above definitions (values and signs) are not applicable (for example : discontinuity, central chord line), dihedral angles to starboard and to port of the point P will be defined conventionally as being those at points infinitesimally close to P, to starboard and to port, on the n % chord line. 3 In the case of a trapezoidal wing [6.6 f)], the local effective dihedral angle is constant at all points on the wing.	υ_e

6.7 Empennages

a) Various aerodynamic surfaces other than the wing can be put at the rear and/or the front of the aircraft. Those surfaces, or combinations of those surfaces, are termed "empennages".

In the case where the aircraft has several empennages, several main parts are defined.

Each of those main parts designated "empennage" must be defined by listing the various components that constitute it and specifying the basic component. In such a listing, it is necessary to indicate whether certain ancillary components (for example, fairings, fillets, struts, probes, antennae) or components that are normally portions of other main parts (for example, engine nacelles, parachute housings) are considered part of the main part considered.

b) The definitions relate to a given geometric state (6.1.16) of the empennage, for which the relative positions of the various movable elements that are part of it (for example, control surfaces, trim tabs) are fixed and specified. These definitions are usually used only for particular geometric states corresponding to the neutral positions of control surfaces. For each geometric state, a chord surface bounded by a line termed "contour" (6.5-6.6 c)) is defined for the empennage under consideration.

c) Various empennage configurations exist, for example,

- tailplane,
- single, dorsal or ventral, fin,
- V tail,
- double or multiple fins,
- cruciform tail,
- horizontal, oblique or vertical "canard" (at the front).

6.7.1 Tailplane[1)]

This aerodynamic surface, at the rear of the aircraft, is essentially in a plane parallel to the $x_R y_R$-plane of the aircraft reference axis system (6.1.4). Analogous definitions to those given for the wing (6.6) can be used for the tailplane.

The symbols relating to the tailplane are indicated by the suffix H.

1) In the context of this International Standard, the term "tailplane" is taken to include the fixed surface and the movable surfaces such as the elevator and the trim tabs.

6.7.2 Fin[1]

a) This aerodynamic surface, at the rear of the aircraft, is essentially in a plane parallel to the $z_R x_R$-plane of aircraft reference axis system (6.1.4).

A single vertical surface is considered here. It is usually an aerodynamic surface mounted on top of the fuselage.

b) The single vertical surface can be made up of two aerodynamic surfaces, one mounted above the fuselage (dorsal fin) and one mounted below the fuselage (ventral fin). If the two surfaces are essentially in the same plane, a single contour enclosing both surfaces may be defined. Otherwise, it is necessary to define two distinct contours.

c) In the case where there is a dorsal or a ventral fin, the completion of the contour at the fuselage is achieved by a suitably chosen straight line, termed "root chord line", in a plane parallel to the $x_R y_R$-plane of the aircraft axis system (6.1.4) (see figure 10). For example, this root chord line may be chosen in a manner that gives equality of the following two areas :

— the area external to the fuselage, of the fin projected on the aircraft reference plane;

— the area defined by the fin contour projected on the aircraft reference plane (6.1.1).

d) In the case where the leading-edge and trailing-edge lines meet at a point at one tip of the fin, that point is termed the "tip point" of the fin. The position of the tip point may depend on a supplementary condition. In order to specify this condition, one considers the plane parallel to the $x_R y_R$-plane of the aircraft reference axis system, just in contact with the aircraft surface within a region in the neighbourhood of the fin tip point and wholly outside the aircraft. When this plane is also in contact with the fin surface, that point of contact is the tip point.

In the case where the leading-edge line and the trailing-edge line do not meet at a fin tip, the contour is completed by a suitably chosen segment of a straight line, termed "tip chord line", in a plane parallel to the $x_R y_R$-plane of the aircraft reference axis system.

The tip point or tip chord line separate the leading-edge line from the trailing-edge line of the tip considered.

In the following tables, the term "upper tip" denotes :

— in the case of a dorsal fin, its upper tip point or its upper tip chord line;

— in the case of a ventral fin, its root chord line.

The term "lower tip" denotes :

— in the case of a dorsal fin, its root cord line;

— in the case of a ventral fin, its lower tip point or its lower tip chord line.

e) The symbols relating to the fin are indicated by the suffix V.

No.	Term	Definition	Symbol
6.7.2.1	Fin axis system	Reference axis system of the basic component (6.1.13) of the fin. NOTE — When the fin contour is in the aircraft reference plane (6.1.1), the $z_V x_V$-plane coincides with that plane.	$x_V y_V z_V$
6.7.2.2	Fin reference plane	The $z_V x_V$-plane of the fin axis system (6.7.2.1).	$z_V x_V$
6.7.2.3	Fin setting	The setting (6.1.15) of the fin axis system (6.7.2.1) with respect to the aircraft reference axis system (6.1.4).	
6.7.2.4	Fin setting angle	In the particular case where the z_V-axis of the fin axis system (6.7.2.1) is parallel to the z_R-axis of the aircraft reference axis system (6.1.4), the angle through which the x_R-axis must be turned about the z_R-axis to bring it parallel to the x_V-axis. This angle is positive when the rotation is made in the positive sense.	
6.7.2.5	Fin tip height	Distance between the $x_R y_R$-plane of the aircraft reference axis system (6.1.4) and the plane parallel to the $x_R y_R$-plane, just in contact with the upper or lower portions of the fin contour, and wholly outside it.	

1) In the context of this International Standard, the term "fin" is taken to include the movable surfaces such as the rudder and the trim tab.

No.	Term	Definition	Symbol
6.7.2.6	Fin height	Distance between the two planes parallel to the $x_R y_R$-plane of the aircraft *reference axis system* (6.1.4), *one of which is just in contact with the up*per portion and the other just in contact with the lower portion of the fin contour, and wholly outside it.	
6.7.2.7	Fin local chord line	Segment of a straight line joining the points of intersection of the leading-edge and trailing-edge lines of the fin contour (6.7.2) with a plane parallel to the $x_R y_R$-plane of the aircraft reference axis system (6.1.4) and located at the coordinate z (see figure 10).	
6.7.2.8	Fin local chord	Length of the fin local chord line (6.7.2.7).	
6.7.2.9	Fin reference chord line	Fin root chord line (6.7.2) if it exists, or an appropriately chosen fin local chord line (6.7.2.7).	
6.7.2.10	Fin n % chord point	Point on a fin local chord line (6.7.2.7) that is situated at a distance behind the leading edge equal to n % of the fin local chord (6.7.2.8).	
6.7.2.11	Fin n % chord line	Locus of the fin n % chord points (6.7.2.10) (see figure 10). NOTE — The 0 % chord line is the leading-edge line. The 100 % chord line is the trailing-edge line.	
6.7.2.12	Fin chord surface	Surface, generally twisted, formed by the fin local chord lines (6.7.2.7).	
6.7.2.13	Fin area	Area of the projection of the fin chord surface (6.7.2.12) on the aircraft reference plane (6.1.1). $S_V = \int_{z_1}^{z_2} c'_V(z) \times dz$ where $c'_V(z)$ is the length of the projection of the fin local chord line (6.7.2.7) on the aircraft reference plane; z *is the coordinate of the fin local chord line along the* z_R-axis of the aircraft reference axis system (6.1.4); z_1 is the coordinate along the z_R-axis of the "upper tip" [6.7.2 d)]; z_2 is the coordinate along the z_R-axis of the "lower tip" [6.7.2 d)]. NOTES 1 $(z_2 - z_1)$ is equal to the fin height (6.7.2.6). 2 It may be useful to define the fin area by projecting the fin chord surface on some other surface that must be specified (for example, the plane parallel to the *aircraft reference plane and containing the root chord line*). 3 An analagous definition can be given based on the fin local chord lines instead of their projections.	S_V

No.	Term	Definition	Symbol
6.7.2.14	Fin aerodynamic mean chord	Length defined by the relationship : $$c_{aV} = \frac{\int_{z_1}^{z_2} [c'_V(z)]^2 \times dz}{\int_{z_1}^{z_2} c'_V(z) \times dz}$$ where $c'_V(z)$ is the length of the projection of the fin local chord line (6.7.2.7) on the aircraft reference plane (6.1.1); z is the coordinate of the fin local chord line along the z_R-axis of the aircraft reference axis system (6.1.4); z_1 is the coordinate along the z_R-axis of the "upper tip" [6.7.2 d)]; z_2 is the coordinate along the z_R-axis of the "lower tip" [6.7.2 d)]. NOTES 1 $(z_2 - z_1)$ is equal to the fin height (6.7.2.6). 2 The integral that appears in the denominator is equal to the fin area (6.7.2.13). 3 An analogous definition can be given based on the fin local chord lines instead of their projections.	c_{aV} or l_{aV}
6.7.2.15	Fin aerodynamic mean chord line	Segment of the straight line containing the fin reference chord line (6.7.2.9). Its foremost point is at the position defined in 6.7.2.16 and its length is equal to the length defined in 6.7.2.14.	
6.7.2.16	Coordinate of the foremost point of the fin aerodynamic mean chord line	Coordinate along the x_R-axis of the aircraft reference axis system (6.1.4) of the foremost point of the fin aerodynamic mean chord line (6.7.2.15) having the following value : $$x_{aV} = \frac{\int_{z_1}^{z_2} c'_V(z) \times x(z) \times dz}{\int_{z_1}^{z_2} c'_V(z) \times dz}$$ where $c'_V(z)$ is the length of the projection of the fin local chord line (6.7.2.7) on the aircraft reference plane (6.1.1); $x(z)$ and z are the coordinates along the x_R- and z_R-axes of the foremost point of the fin local chord line; z_1 is the coordinate along the z_R-axis of the "upper tip" [6.7.2 d)]; z_2 is the coordinate along the z_R-axis of the "lower tip" [6.7.2 d)]. NOTES 1 $(z_2 - z_1)$ is equal to the fin height (6.7.2.6). 2 The integral that appears in the denominator is equal to the fin area (6.7.2.13). 3 An analagous definition can be given based on the local chord lines instead of their projections.	x_{aV}
6.7.2.17	Fin local geometric twist angle	Angle through which the fin reference chord line (6.7.2.9) must be turned about the z_R-axis of the aircraft reference axis system (6.1.4) to bring it parallel to the fin local chord line (6.7.2.7). That angle is positive when the rotation is made in the positive sense.	

No.	Term	Definition	Symbol
6.7.2.18	Fin local sweep angle	Angle between the $y_R z_R$-plane of the aircraft reference axis system (6.1.4) and the projection on the $z_R x_R$-plane (6.1.1) of the tangent at a point P on the fin chord surface (6.7.2.12) to the fin n % chord line (6.7.2.11) passing through P (see figure 10). That angle is positive if the point T, where the tangent at P and the $x_R y_R$-plane intersect, is in front of the point P. NOTE — In the case where the definitions (values and signs) are not applicable (for example : discontinuity), the sweep angles above and below the point P will be defined conventionally as being those at points infinitesimally close to P, above and below, on the fin n % chord line.	φ_V

6.7.3 Other empennages

Suitable definitions may be developed on similar lines for other empennage configurations such as those listed in 6.7.

6.8 Figures

Figures 1 to 10 illustrate part 6, *Aircraft geometry.*

In figures 1 to 9, only the starboard part of the wing is represented. The shape of this part has been chosen in order to illustrate more clearly the quantities defined in the standard.

In figures 4 to 10, the angles that characterize the sweep angles and dihedral angles at the point P are represented in planes passing through P.

Intended to be printed with different colours, the figures may however be printed in one colour only and differentiation effected by means of different lines (i.e. thicknesses of line, dotted lines, dashed lines).

Figures 2 to 9 are represented in isometric projection (central projection).

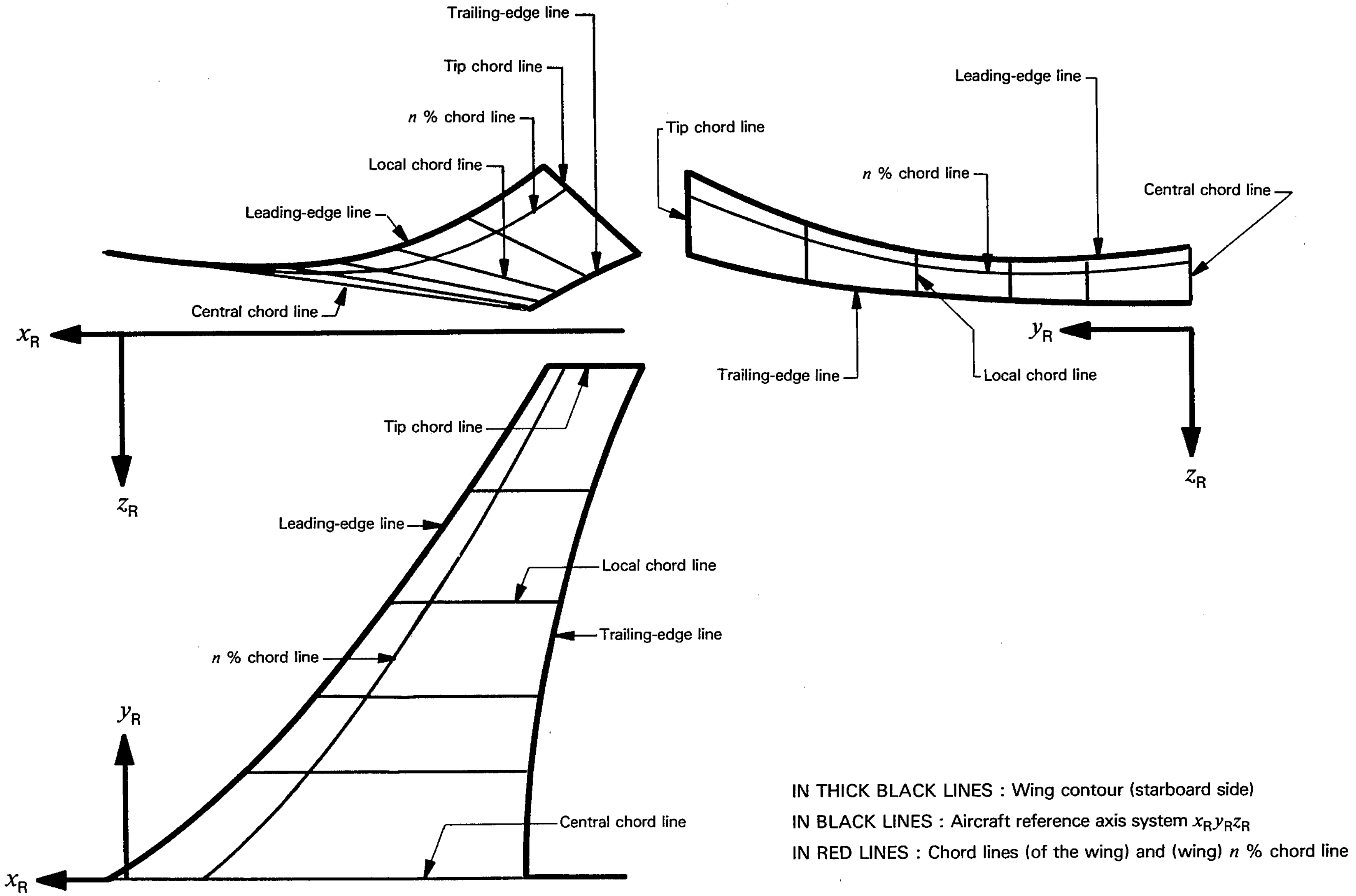
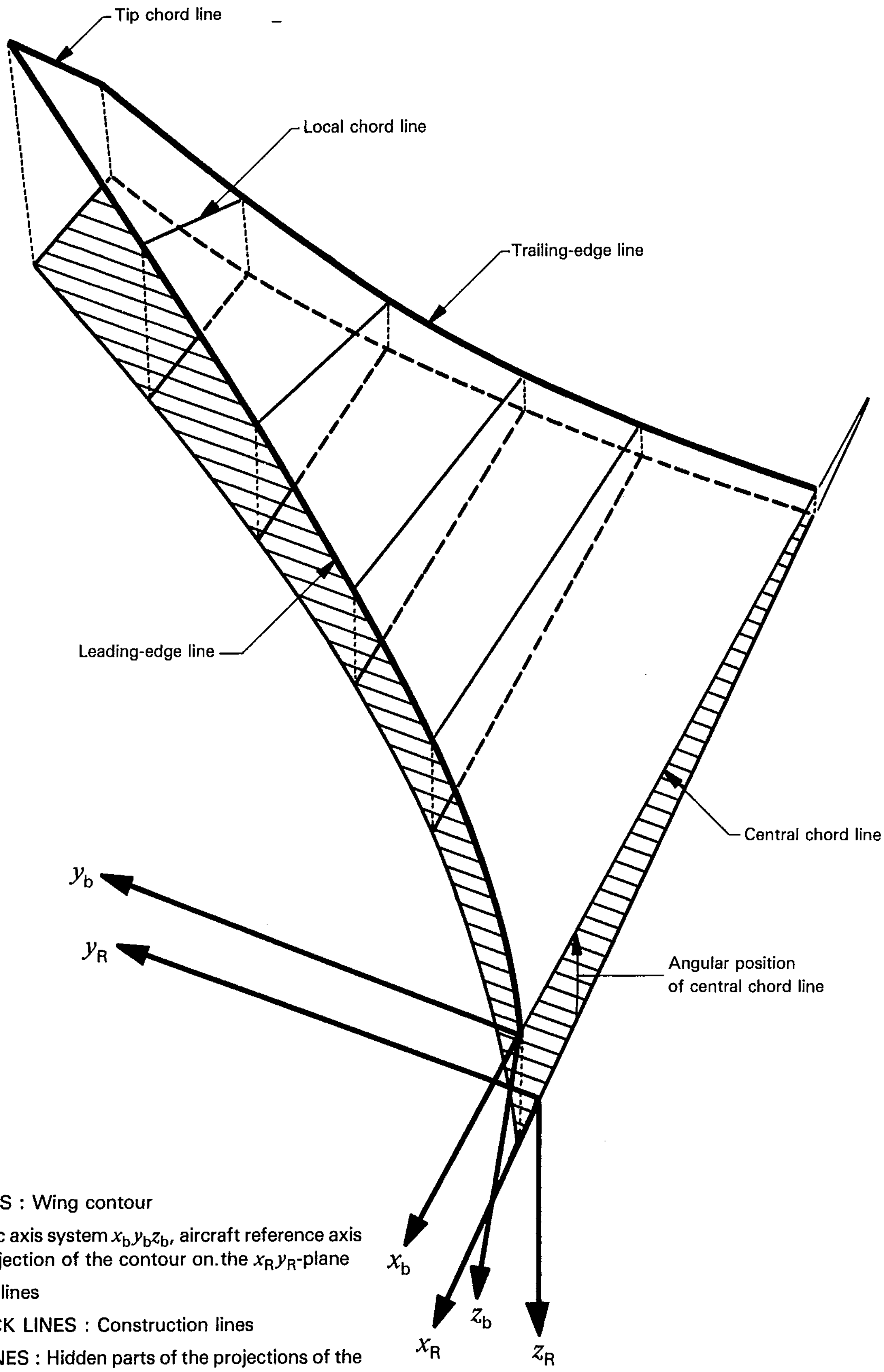


Figure 1 — Starboard part of the wing contour projected on the planes of the aircraft reference axis system



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Basic axis system $x_b y_b z_b$, aircraft reference axis system $x_R y_R z_R$ and projection of the contour on.the $x_R y_R$-plane

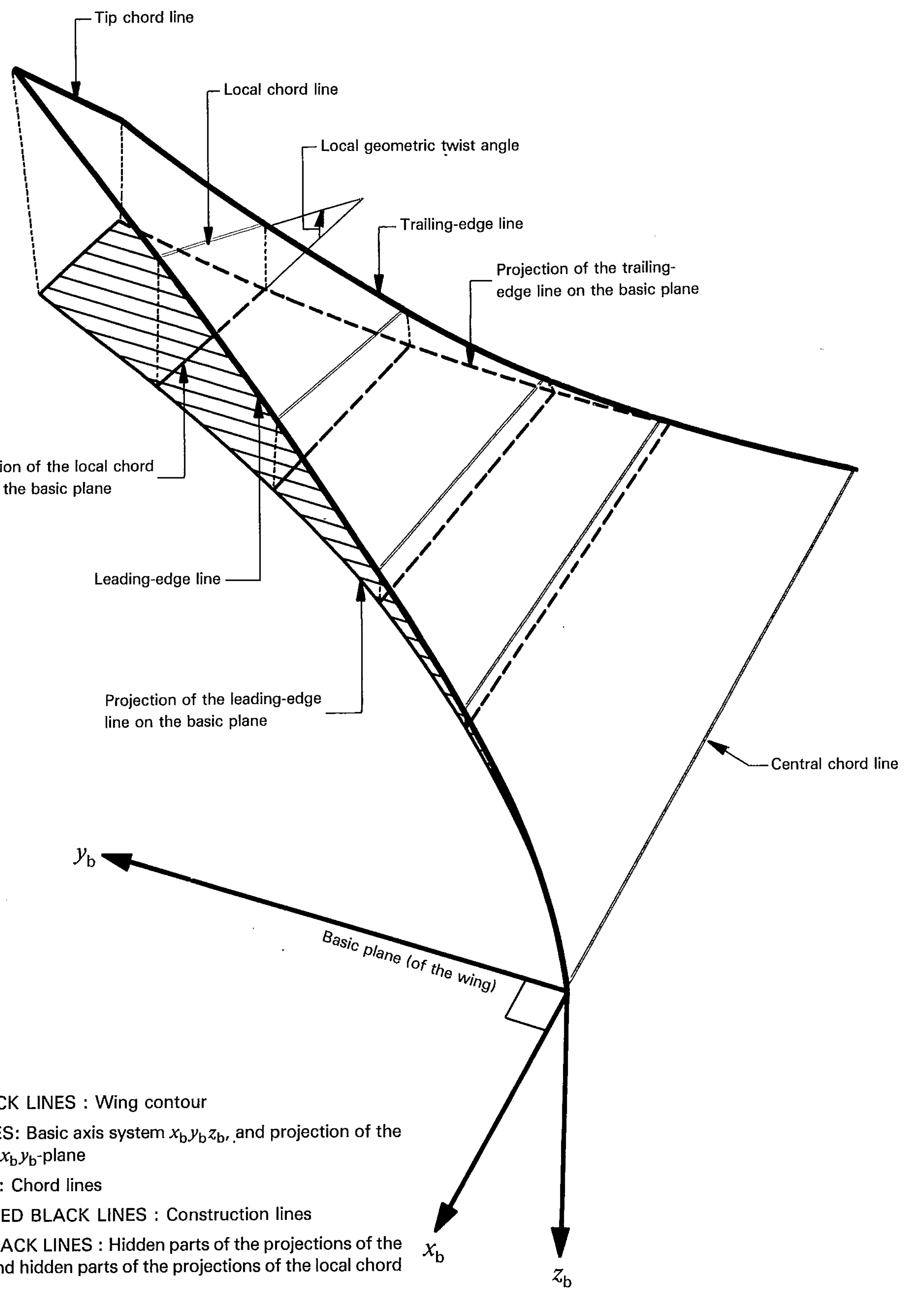
IN RED LINES : Chord lines

IN THIN DASHD BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden parts of the projections of the wing contour and the local chord lines

NOTE — The angle shown [angular position of the (wing) central chord line, item 6.6.9] is positive.

Figure 2 — Basic axis system of the wing and aircraft reference axis system; wing contour and (wing) chord surface



IN THICK BLACK LINES : Wing contour

IN BLACK LINES: Basic axis system $x_b y_b z_b$, and projection of the contour on the $x_b y_b$-plane

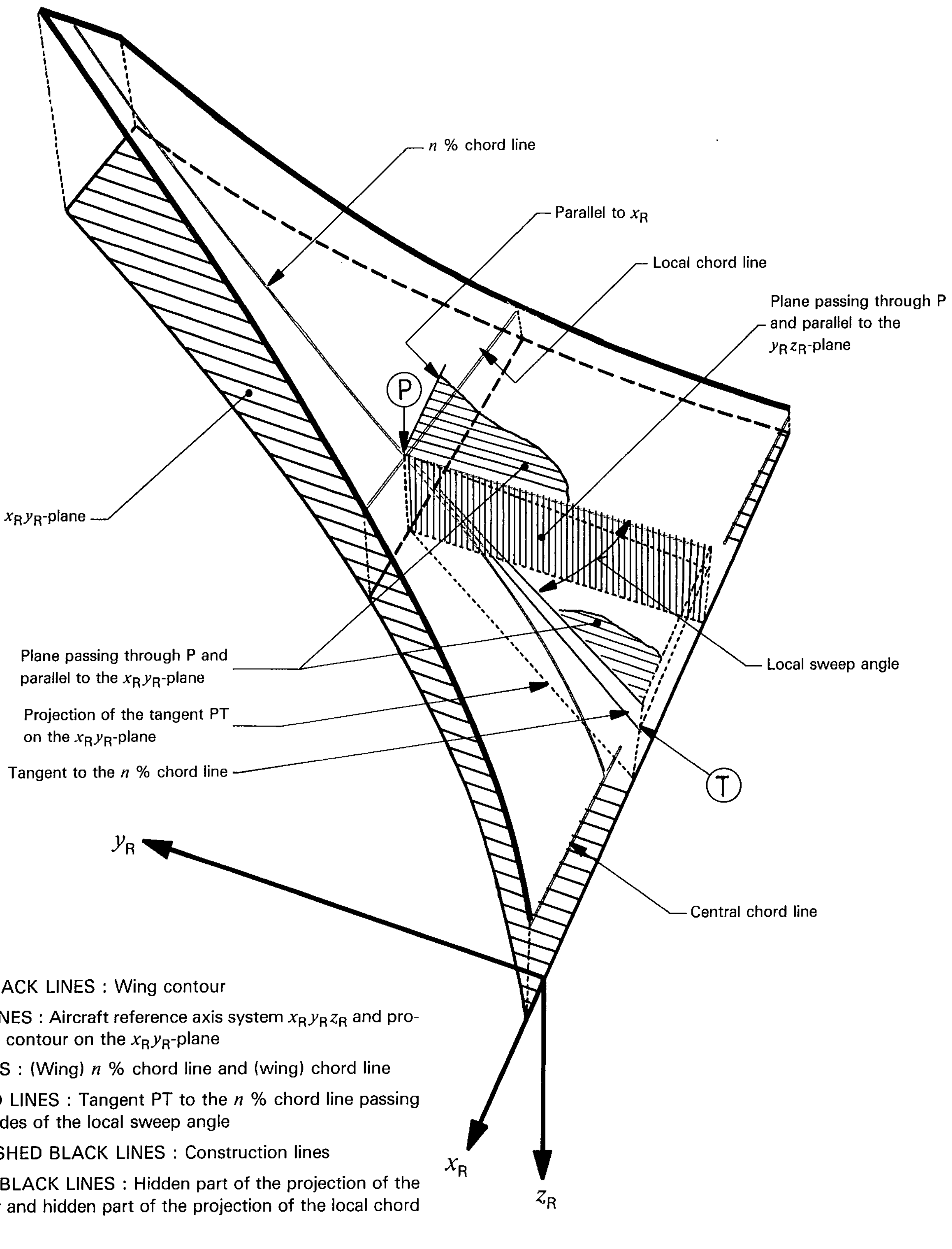
IN RED LINES : Chord lines

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden parts of the projections of the wing contour and hidden parts of the projections of the local chord lines

NOTE — The angle shown [local geometric twist angle (of the wing), item 6.6.21] is positive.

Figure 3 — Local geometric twist angle (of the wing)



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Aircraft reference axis system $x_R y_R z_R$ and projection of the contour on the $x_R y_R$-plane

IN RED LINES : (Wing) *n* % chord line and (wing) chord line

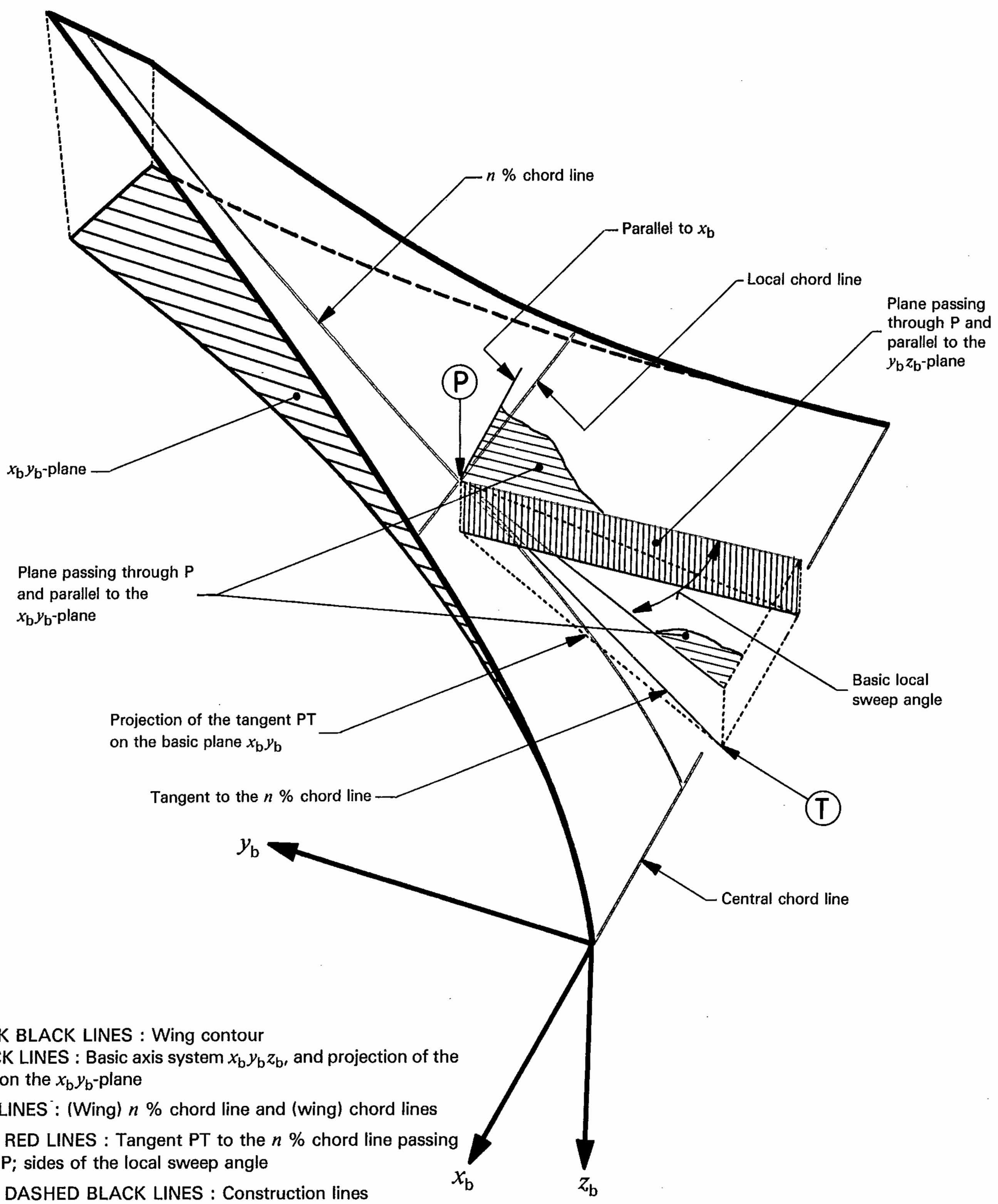
IN THIN RED LINES : Tangent PT to the *n* % chord line passing through P; sides of the local sweep angle

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden part of the projection of the wing contour and hidden part of the projection of the local chord line

NOTE — The angle shown [local sweep angle (of the wing), item 6.6.22] is positive.

Figure 4 — Local sweep angle (of the wing)



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Basic axis system $x_b y_b z_b$, and projection of the contour on the $x_b y_b$-plane

IN RED LINES : (Wing) *n* % chord line and (wing) chord lines

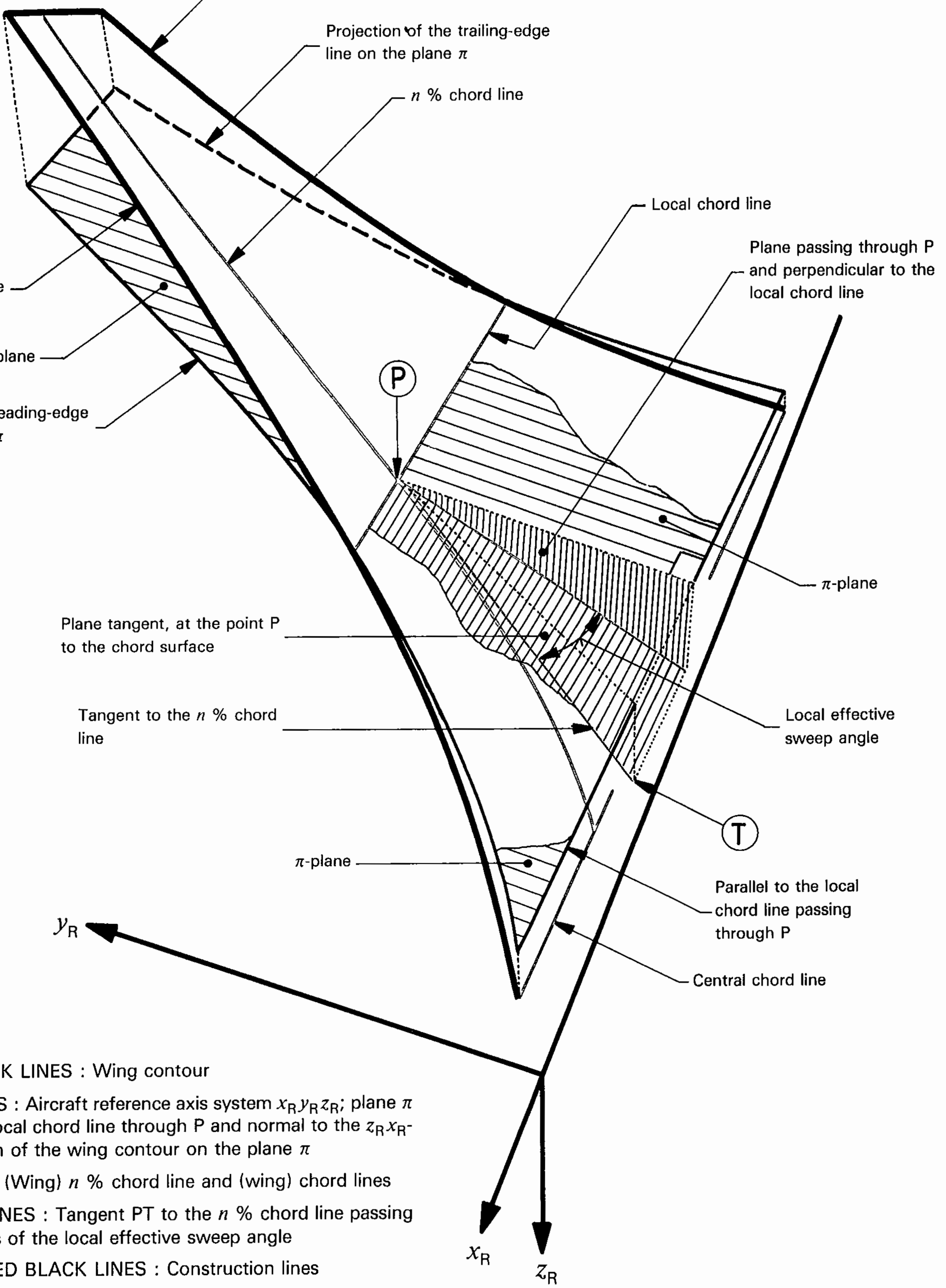
IN THIN RED LINES : Tangent PT to the *n* % chord line passing through P; sides of the local sweep angle

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden part of the projection of the wing contour.

NOTE — The angle shown [basic local sweep angle (of the wing), item 6.6.22, note 2] is positive.

Figure 5 — Basic local sweep angle (of the wing)



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Aircraft reference axis system $x_R y_R z_R$; plane π containing the local chord line through P and normal to the $z_R x_R$-plane. Projection of the wing contour on the plane π

IN RED LINES : (Wing) n % chord line and (wing) chord lines

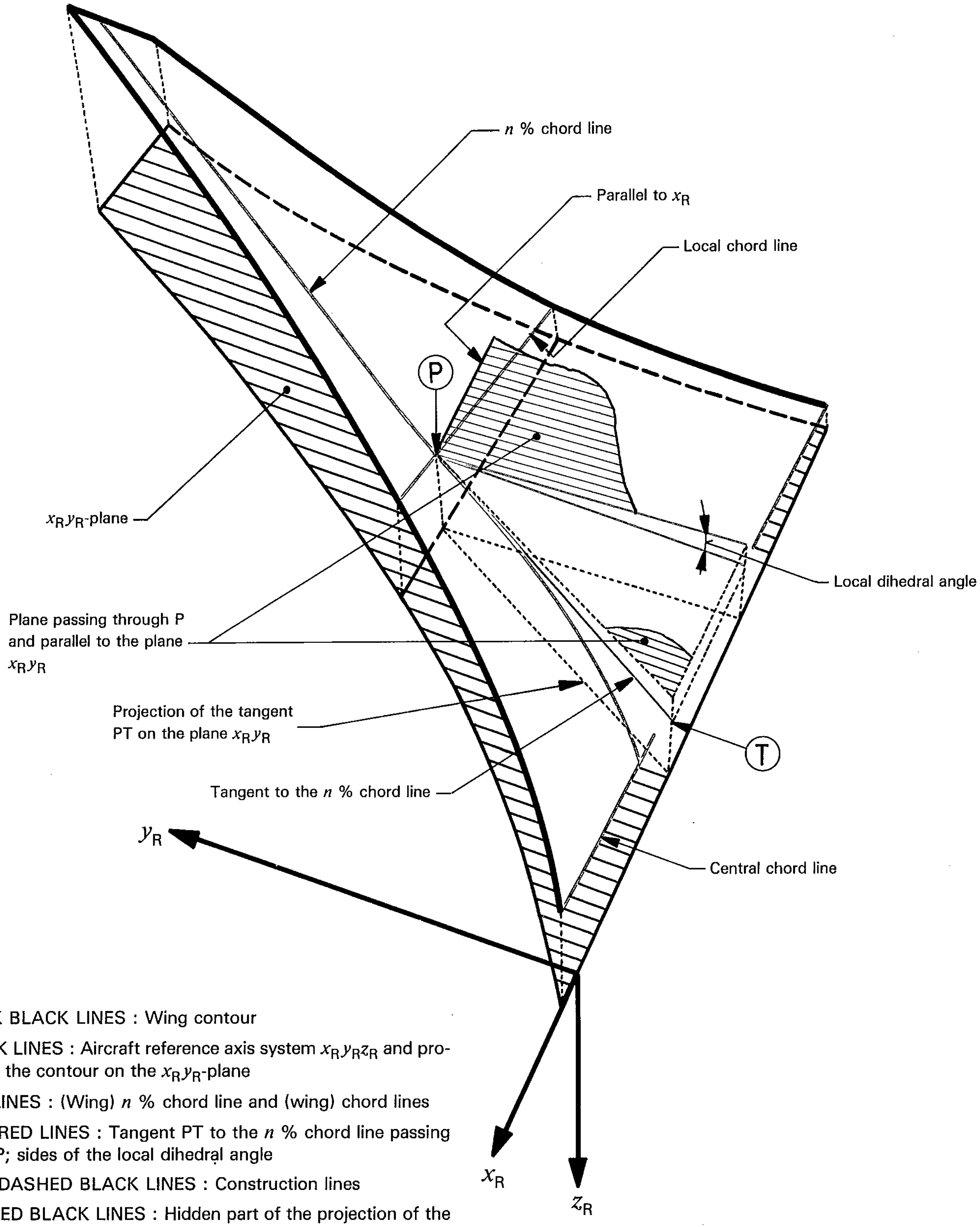
IN THIN RED LINES : Tangent PT to the n % chord line passing through P; sides of the local effective sweep angle

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden part of the projection of the wing contour on the plane π

NOTE — The angle shown [local effective sweep angle (of the wing), item 6.6.23] is positive.

Figure 6 — Local effective sweep angle (of the wing)



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Aircraft reference axis system $x_R y_R z_R$ and projection of the contour on the $x_R y_R$-plane

IN RED LINES : (Wing) n % chord line and (wing) chord lines

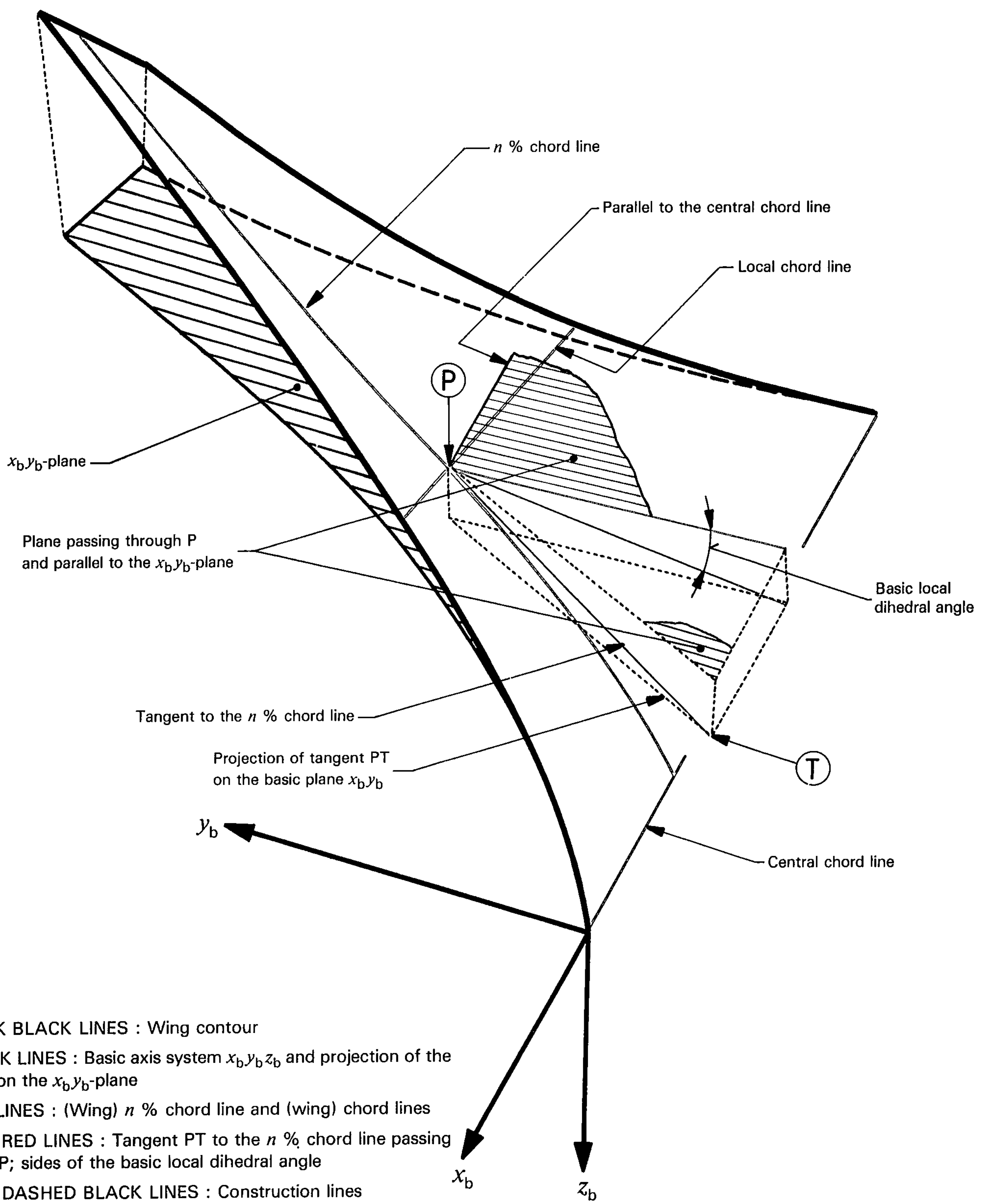
IN THIN RED LINES : Tangent PT to the n % chord line passing through P; sides of the local dihedral angle

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden part of the projection of the wing contour and hidden part of the projection of the local chord line

NOTE — The angle shown [local dihedral angle (of the wing), item 6.6.24] is positive.

Figure 7 — Local dihedral angle (of the wing)



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Basic axis system $x_b y_b z_b$ and projection of the contour on the $x_b y_b$-plane

IN RED LINES : (Wing) *n* % chord line and (wing) chord lines

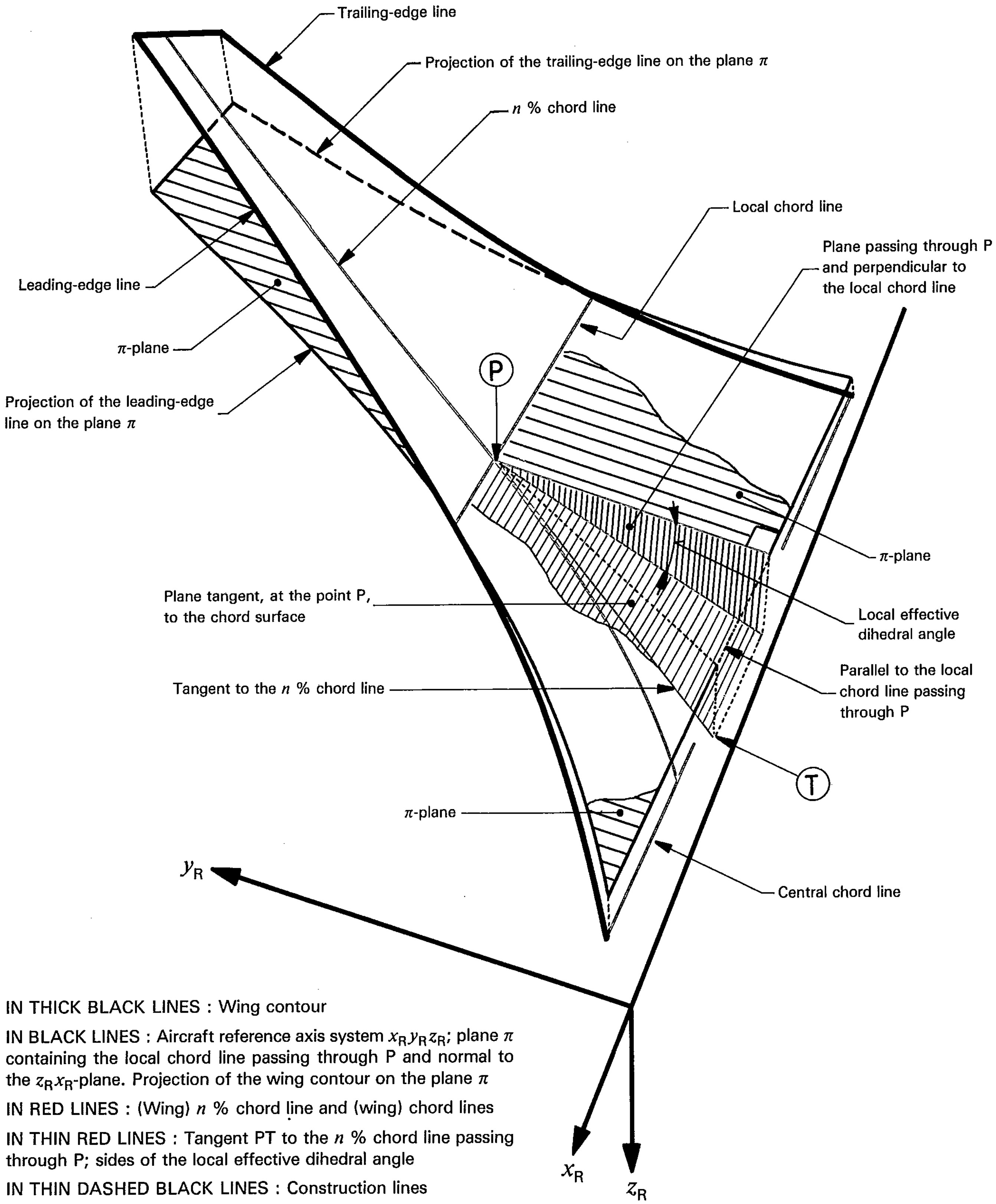
IN THIN RED LINES : Tangent PT to the *n* % chord line passing through P; sides of the basic local dihedral angle

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden part of the projection of the wing contour

NOTE — The angle shown [basic local dihedral angle (of the wing), item 6.6.24, note 2] is positive.

Figure 8 — Basic local dihedral angle (of the wing)



IN THICK BLACK LINES : Wing contour

IN BLACK LINES : Aircraft reference axis system $x_R y_R z_R$; plane π containing the local chord line passing through P and normal to the $z_R x_R$-plane. Projection of the wing contour on the plane π

IN RED LINES : (Wing) n % chord line and (wing) chord lines

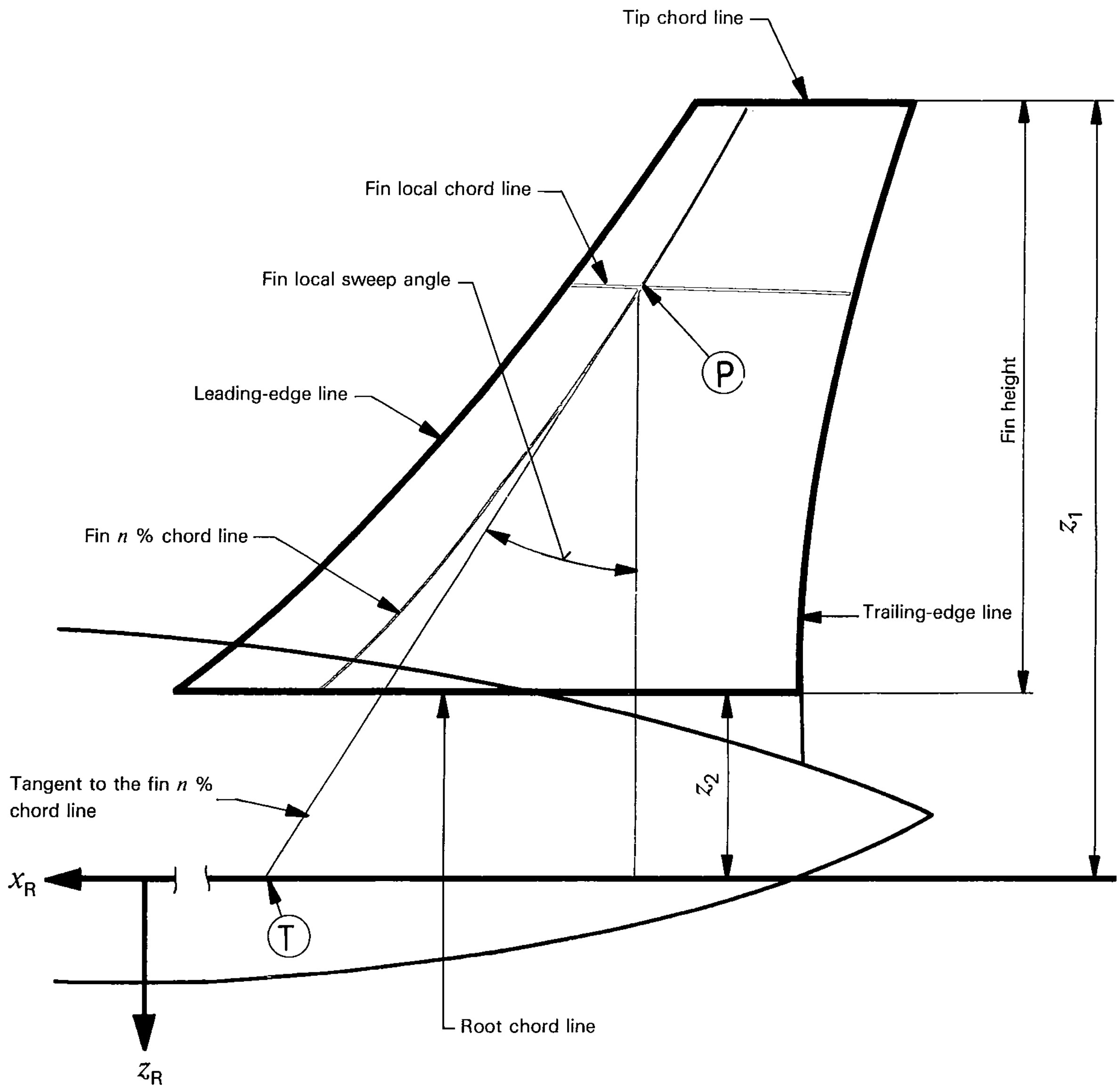
IN THIN RED LINES : Tangent PT to the n % chord line passing through P; sides of the local effective dihedral angle

IN THIN DASHED BLACK LINES : Construction lines

IN DASHED BLACK LINES : Hidden part of the projection of the wing contour on the plane π

NOTE — The angle shown [local effective dihedral angle (of the wing), item 6.6.25] is positive.

Figure 9 — Local effective dihedral angle (of the wing)



IN THICK BLACK LINES : Fin contour

IN BLACK LINES : Aircraft reference axis system $x_R y_R z_R$ and fuselage

IN RED LINES : (Fin) *n* % chord line and (fin) chord lines

IN THIN RED LINES : Tangent PT to the fin *n* % chord line passing through P; second side of the fin local sweep angle

NOTE — The angle shown [fin local sweep angle, item 6.7.2.18] is positive.

Figure 10 — Fin