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Flight dynamics — Concepts, quantities and symbols —

Part 4:

Concepts, quantities and symbols used in the study
of aircraft stability and control

Mécanique du vol — Concepts, grandeurs et symboles —

*Partie 4: Concepts, grandeurs et symboles utilisés pour l'étude de la stabilité et du
pilotage des avions*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1151-4 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Sub-Committee SC 3, *Concepts, quantities and symbols for flight dynamics*.

ISO 1151 consists of the following parts, under the general title *Flight dynamics — Concepts, quantities and symbols*:

- Part 1: *Aircraft motion relative to the air*
- Part 2: *Motions of the aircraft and the atmosphere relative to the Earth*
- Part 3: *Derivatives of forces, moments and their coefficients*
- Part 4: *Concepts, quantities and symbols used in the study of aircraft stability and control*
- Part 5: *Quantities used in measurements*
- Part 6: *Aircraft geometry*
- Part 7: *Flight points and flight envelopes*
- Part 8: *Concepts and quantities used in the study of the dynamic behaviour of the aircraft*
- Part 9: *Models of atmospheric motions along the trajectory of the aircraft*

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ISO 1151 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 all the parts comprising ISO 1151, 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: fore-and-aft and dorsal-ventral. The transverse direction, on the perpendicular to that plane, follows.

When there is a single plane of symmetry, it is the reference plane of the aircraft. When there is more than one plane of symmetry, or when there is none, it is necessary to choose 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.

The centre of gravity coincides with the centre of mass if the field of gravity is homogeneous. If this is not the case, the centre of gravity can be replaced by the centre of mass in the definitions of ISO 1151; in which case, this should be indicated.

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 ISO 1151 considered.

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Flight dynamics — Concepts, quantities and symbols —

Part 4:

Concepts, quantities and symbols used in the study of aircraft stability and control

4.0 Introduction

This part of ISO 1151 deals with the concepts, quantities and symbols used in the study of aircraft stability and control.

4.1 Controls

The following definitions, except for those in 4.1.4, are applicable to an aircraft whose main controls (7.2.1.1) are:

- stick or wheel for pitch (4.1.1.1) and roll (4.1.2.1) controls;
- pedals for yaw control (4.1.3.1).

NOTES

- 1 Where there is no possibility of confusion, the letter δ may be omitted from the symbols given in 4.1.1 to 4.1.4.
- 2 The symbols adopted for the displacements of the controls are usual ones but do not necessarily conform to the normally adopted conventions.

4.1.1 Pitch control

No.	Term	Definition	Symbol
4.1.1.1	Pitch control	Control (7.2.1.1) enabling the pilot to change the pitching moment (1.5.5).	—
4.1.1.2	Displacement of the pitch control	Displacement of a reference point fixed to the pitch control (4.1.1.1) within a suitably chosen reference system. It is positive in the forward direction (6.0.4).	$D_{\delta m}$
4.1.1.3	Effort on the pitch control	Force exerted by the pilot on the pitch control (4.1.1.1). It is positive in the forward direction (6.0.4) ("pushing force").	$E_{\delta m}$
4.1.1.4	Pitch trim control	Control enabling the pilot to change the force on the pitch control (4.1.1.3). NOTE — In most cases, this control is used to reduce or to cancel the force on the pitch control (4.1.1.3) for a considered flight state (8.1.2).	—

4.1.2 Roll control

No.	Term	Definition	Symbol
4.1.2.1	Roll control	Control (7.2.1.1) enabling the pilot to change the rolling moment (1.5.5).	—
4.1.2.2	Displacement of the roll control	(1) Stick: Displacement of a reference point fixed to the roll control (4.1.2.1) within a suitably chosen reference system. It is positive in the port direction (as defined in 6.0.4). (2) Wheel: Angle of rotation of the roll control, negative in the clockwise direction for the pilot.	$D_{\delta l}$
4.1.2.3	Effort on the roll control	(1) Stick: Force exerted by the pilot on the roll control (4.1.2.1). It is positive in the port direction (6.0.4). (2) Wheel: Moment resulting from the force applied by the pilot on the wheel divided by the wheel radius. This force is negative when the mentioned torque is exerted in the clockwise direction for the pilot.	$E_{\delta l}$
4.1.2.4	Roll trim control	Control enabling the pilot to change the force on the roll control (4.1.2.3). NOTE — In most cases, this control is used to reduce or to cancel the force on the roll control (4.1.2.3) for a considered flight state (8.1.2).	—

4.1.3 Yaw control

No.	Term	Definition	Symbol
4.1.3.1	Yaw control	Control (7.2.1.1) enabling the pilot to change the yawing moment (1.5.5).	—
4.1.3.2	Displacement of the yaw control	Displacement of a reference point fixed to the yaw control (4.1.3.1) within a suitably chosen reference system. It is positive when the left foot of the pilot moves in the forward direction (6.0.4).	$D_{\delta n}$
4.1.3.3	Effort on the yaw control	Force exerted by the pilot on the yaw control (4.1.3.1). It is positive when the pilot pushes in the forward direction (6.0.4) with his left foot.	$E_{\delta n}$
4.1.3.4	Yaw trim control	Control enabling the pilot to change the force on the yaw control (4.1.3.3). NOTE — In most cases, this control is used to reduce or to cancel the force on the yaw control (4.1.3.3) for a considered flight state (8.1.2).	—

4.1.4 Lift control

This type of control is used on helicopters. This control acts on the collective pitch of the blades of the main rotor. It is in general a lever at the side of the pilot.

No.	Term	Definition	Symbol
4.1.4.1	Collective pitch control; lift control	Control (7.2.1.1) enabling the pilot of a helicopter to modify the lift (1.6.2.8) by varying the mean setting of the blades of the main rotor.	—
4.1.4.2	Displacement of the collective pitch control	Displacement of a reference point fixed to the collective pitch control (4.1.4.1) within a suitably chosen reference system. It is positive in the upward direction (as defined in 6.0.4).	$D_{\delta z}$