

INTERNATIONAL STANDARD

ISO
1151-3

Second edition
1989-04-01

Flight dynamics — Concepts, quantities and symbols —

Part 3 : Derivatives of forces, moments and their coefficients

Mécanique du vol — Concepts, grandeurs et symboles —

Partie 3 : Dérivées des forces, des moments et de leurs coefficients



Reference number
ISO 1151-3 : 1989 (E)

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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.

When 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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1151-3 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

This second edition cancels and replaces the first edition (ISO 1151-3 : 1972), of which it constitutes a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

ISO 1151, *Flight dynamics — Concepts, quantities and symbols*, comprises, at present, seven parts:

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: Parameters 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.

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 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 this 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.

Flight dynamics — Concepts, quantities and symbols —

Part 3:

Derivatives of forces, moments and their coefficients

3.0 Introduction

This part of ISO 1151 deals with derivatives of forces, moments and of other quantities characterizing such forces and moments.

The term "derivative" designates the partial derivative of a function with respect to an independent variable.

These derivatives appear in the terms of the Taylor series representing the variations of functions with the independent variables. This part of ISO 1151 is restricted to first-order terms. Terms of higher order would require additional definitions for derivatives of higher order.

The aircraft is assumed to be rigid. However, most of the definitions can be applied to the case of flexible aircraft. Aerolastic effects would require the introduction of further quantities.

3.1 Functions and independent variables

A set of derivatives is characterized by the set of the functions and the set of the independent variables, with respect to which differentiation takes place.

3.1.1 Functions and classes of derivatives

Different classes of derivatives are used in flight dynamics studies.

This part of ISO 1151 includes the following classes of derivatives:

Clause	Class	Distinguishing mark
3.2	Direct derivatives	
3.3	Specific derivatives	~
3.4	Normalized derivatives	^
3.5	Coefficient derivatives	

The distinguishing marks may be omitted if no confusion is likely.

In each class, the specific term for a particular derivative shall refer to the function and to the independent variable.

The functions used in a given problem refer to only one axis system.

In the chosen axis system, the components are numbered as follows:

- 1 Component with respect to the x -axis
- 2 Component with respect to the y -axis
- 3 Component with respect to the z -axis