
**Aerospace — Fluid systems —
Vocabulary —**

Part 4:

**General terms and definitions relating to
control/actuation systems**

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*Aéronautique et espace — Systèmes de fluides — Vocabulaire —
Partie 4: Termes et définitions généraux relatifs aux systèmes de
commande/d'actionnement*

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Contents

Page

Foreword	iv
Introduction	v
Scope	1
Terms and definitions	1
4.1 Control system classification	1
4.2 Control system technology (control engineering)	3
4.3 Control system performance (servomechanism)	9

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8625-4 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

ISO 8625 consists of the following parts, under the general title *Aerospace — Fluid systems — Vocabulary*:

- *Part 1: General terms and definitions relating to pressure*
- *Part 2: General terms and definitions relating to flow*
- *Part 3: General terms and definitions relating to temperature*
- *Part 4: General terms and definitions relating to control/actuation systems*

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Introduction

ISO 8625 contains only those terms which can be applied to general equipment and systems. Terms which are only used for specific applications and specific components are to be incorporated into the relevant product specifications and product standards.

Terms and definitions for components and systems which are associated with other systems (such as electromechanical actuation systems or electronic control units) are incorporated only on a very general basis, provided they have direct interfaces with fluid systems.

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Aerospace — Fluid systems — Vocabulary —

Part 4: General terms and definitions relating to control/actuation systems

Scope

This part of ISO 8625 defines general terms relating to control/actuation systems in the field of aerospace fluid systems and components.

Terms and definitions

For the purposes of ISO 8625, terms have been given a two-element number: the first element refers to the number of the part of ISO 8625 in which the term is defined and the second element refers to the reference number of the term within that part.

EXAMPLE

4.3.38 <https://standards.iteh.ai/catalog/standards/sist/25d724f2-c3eb-417b-9064-33d78aa1053/iso-8625-4-2011>
velocity vs. force/torque characteristics
the term “velocity vs. force/torque characteristics” is defined in ISO 8625-4

Terms are presented according to the alphabetical order of terms in English.

4.1 Control system classification

4.1.1

adaptive control system

control system which improves system performance by changing system parameters in response to varying operational conditions

4.1.2

AFCS

automatic flight control systems

systems consisting of electrical, mechanical and hydraulic components that generate and transmit automatic control commands, which provide pilot assistance through automatic or semiautomatic flight path control or which automatically control airframe response to disturbances

NOTE 1 This classification includes automatic pilots, stick or wheel steering, autothrottles, structural mode control and similar mechanizations.

NOTE 2 AFCS functions include, but are not limited to, airspeed hold, automatic navigation, all weather landing, automatic terrain following, altitude hold, heading hold, altitude select, heading select, attitude hold (pitch and roll), lateral acceleration and sideslip limiting, automatic instrument, low approach mach hold, automatic carrier landing, automatic vectoring modes.

4.1.3

autobrake

automatic/electronic control of braking of a specific energy level

4.1.4

autoland

automatic/electronic control that takes the aircraft all the way to a full land

4.1.5

autothrottle

control means which sets a given position to maintain thrust for a given attitude/speed combination

4.1.6

bistable control system

control system in which the control output is fully on in either polarity

NOTE When the time is modulated by the input, the system is called pulse width modulated (PWM). The terms "ON-OFF control" and "bang-bang control" are sometimes used. These types of controls pertain to digital controls.

4.1.7

closed-loop control system

control system in which measurement of the output parameter is used to make system corrections so as to maintain a desired output based on input commands

4.1.8

CAS

control augmentation system

vehicle flight control system wherein the control system responds to the error between commanded vehicle motion and the actual vehicle motion as well as to surface position command inputs

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4.1.9

control and stability augmentation system

combination of **CAS** (4.1.8) and **SAS** (4.1.20)

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4.1.10

control authority

total amount of control surface or force effector deflection available to a flight control system

NOTE The prefixes "pilot", "CAS" or "SAS" are often used to define that part of the total available to the pilot, the CAS or the SAS, respectively.

4.1.11

control system

system in which deliberate guidance or manipulation is used to achieve a prescribed value of a variable

NOTE A control system has at least one input and one output.

4.1.12

digital control system

control system which uses digital signals and wherein the control information is digital

4.1.13

flight control systems

systems that enable the controlled flight of aircraft, helicopters and missiles

NOTE "Manual flight control systems" transmit pilot commands through mechanical components, though they often incorporate electrical components to augment the pilot commands. The term is also sometimes used for those systems which transmit pilot commands to the surfaces mechanically, without power or force assistance.

4.1.14**fly by wire (FBW) system**

control by wire (CBW) system

control system wherein control information and signals are transmitted completely by electrical means

4.1.15**fly by light (FBL) system**

control by light (CBL) system

control system wherein control information is transmitted by light through a fibre optic cable

NOTE A true FBL system does not have FBW or mechanical backup, nor FBW or mechanical override.

4.1.16**hydraulic boost**

use of hydraulic power actuation to reduce the pilot effort needed for control of a vehicle wherein the actuator output force or torque is in direct proportion to the manual, mechanically applied, input force or torque

4.1.17**integral control system**

control system, which uses an integrator in the control loop elements to provide an output response to the error signal, and for which the control effort is proportional to the integral of the error

4.1.18**open-loop control**

control system in which an output is produced in direct response to a command, without feedback from the output being used to affect the system response

4.1.19**proportional control system**

control system which uses proportional control elements in its forward or feedback control paths, or both, to provide an output in response to the error signal

4.1.20**SAS****stability augmentation system**

portion of a flight control system that improves the handling characteristics by modifying the aerodynamic response of the vehicle

NOTE The SAS generally has limited authority. SAS signals are normally introduced by a series servo, the operation of which does not have an impact on the pilot's command signal.

4.1.21**tristable control system**

control system in which the power to control the load is fully on in one polarity, off, or fully on in the other polarity (tristable)

NOTE When the time is modulated by the input, the system is called pulse width modulated (PWM). The terms "ON-OFF control" and "bang-bang control" are sometimes used. These types of controls pertain to digital controls.

4.2 Control system technology (control engineering)**4.2.1****backlash**

uncontrolled load motion due to clearance in actuation elements, including the load attach point, usually expressed in terms of absolute load motion

4.2.2

bandwidth

frequency range over which the actuation system has acceptable dynamic response

NOTE This spectrum extends from a base frequency up to a specified frequency, which is usually the frequency where the open-loop amplitude ratio has unity gain (0 dB) in other than single order systems. For a first order system, this is the frequency where the closed-loop response is down 3 dB and the phase lag is 45° [see also **decibel** (4.2.6)].

4.2.3

closed-loop frequency response

frequency response between command input and control system output with the feedback signal summed algebraically with command

NOTE Actuation system response for a closed-loop system is usually specified as closed-loop frequency response.

4.2.4

command

input which represents the desired output of the control system

4.2.5

control passband

frequency range over which the control responds without attenuation

4.2.6

decibel

dB

unit of measure used to express amplitude ratio of output to control input

NOTE Decibels = $20 \log_{10}$ (amplitude out/amplitude in).

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4.2.7

dynamic impedance

impedance, a complex quantity, associated with the output deflections of an active, closed-loop actuation system caused by externally applied dynamic forces, usually sinusoidal, over a specific frequency range

NOTE Dynamic impedance at the surface includes the effects of the surface attachment spring, its load mass and its viscous friction. The impedance at the actuator will not include these factors.

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4.2.8

error signal

algebraic difference between the command input and the output feedback

4.2.9

feedback element

component in a closed-loop system that provides the feedback signal of the output quantity, or a function of the output that can be compared with the reference input

4.2.10

forward loop control elements

elements situated between the error signal and the controlled variable

4.2.11

frequency response

complex ratio of the actuation system output to the command input while the input is cycled sinusoidal at a constant amplitude and the frequency is varied

NOTE Frequency response is usually presented as a log frequency plot of normalized amplitude ratio, expressed in dB, and input to output phase angle degrees versus frequency.

4.2.12**gain crossover**

point of the plot of the open-loop transfer function at which the magnitude is unity ($LmG(j\omega) = 0$ dB)

NOTE The frequency at gain crossover is called the phase margin frequency, ω_{ϕ} .

4.2.13**gain margin**

measure of system stability defined as the gain required to raise the open-loop amplitude ratio to 0 dB (unit gain) at the frequency corresponding to 180° of phase lag

4.2.14**hysteresis**

difference in actuation system output for the same input command level during a complete cycle of input command when cycled throughout the full range of travel

NOTE It is necessary that the cycling rate be significantly below the control bandpass so that velocity error signals are not included in this parameter.

4.2.15**input**

independent variable supplied to the control system

4.2.16**linearity**

degree to which the normal output curve conforms to a straight line under specified load conditions, usually expressed as a percentage of full range, or sometimes of rated output, which is typically half full range

4.2.17**load natural frequency**

undamped resonant frequency of the load mass, coupled with the frequency-independent dynamic stiffness

4.2.18**loop**

signal path in a closed-loop control system beginning with the error signal after a summing point and ending with the resultant feedback signal returning to the same summing point

4.2.19**normal output curve**

locus of the mid-points of a complete input/output curve

NOTE This locus is the zero hysteresis output curve.

4.2.20**normal output gain**

slope of the normal output curve in units of output/input

4.2.21**open-loop frequency response**

frequency response between command input and control system output with no outer loop feedback loop closure

4.2.22**output**

controlled variable resulting from activity of the control system