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Power System Stability Control -
Part 2: Guideline for quantitative assessment of power system stability and security

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Power System Stability Control - Part 2: Guideline for quantitative assessment of power system stability and security

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IEC TS 63384-2 has been prepared by subcommittee 8C: Network management in interconnected electric power systems, of IEC technical committee 8: System aspects of electrical energy supply. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
8C/136/DTS	8C/156/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63384 series, published under the general title *Power system stability control*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

This corrected version of IEC TS 63384-2:2026 incorporates the following correction:

– Addition of bibliographic reference numbers in the content

1 Scope

This Technical Specification (TS) addresses the quantitative assessment of power system stability and security. Its purpose is to provide guidelines encompassing the use of terms and definitions, as well as the objectives and general requirements for conducting quantitative assessments. The TS includes the classification of stability and security, classification of quantitative indices, and key considerations for implementing quantitative assessments. These considerations involve selecting appropriate assessment indices, methods for obtaining these indices, model and data requirements, and strategies for improving assessment efficiency. Examples of quantitative indices are also provided (see informative Annex A).

The application of a stability and security quantitative assessment serves several purposes. Firstly, it establishes an adequate margin to ensure the synchronous operation of the power system and the safety of primary equipment under both normal and abnormal conditions. Additionally, it helps improve the cost-benefit ratio of power system operations. The TS is applicable to various domains, including system planning, operation planning, operation control, stability control system design, and stability control decision planning, as well as software, equipment, and systems for the secure and stable operation of the power system. By using quantitative assessment of stability and security, it is possible to identify key factors that contribute to instability and to develop mitigating methods for enhancing stable operation.

The stability and security quantitative assessment techniques specified in IEC TS 63384-2 are independent of any specific software, equipment, or systems used for the secure and stable operation of the power system.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
stability
<of an electric power system> ability of an electric power system, for a given initial operating condition, to regain a state of operating equilibrium after being subjected to a physical disturbance, with most system variables bounded, so that practically the entire system remains intact [1], [2]

Note 1 to entry: If following a disturbance the power system is stable, it will reach a new equilibrium state with the system integrity preserved, i.e., with practically all generators and loads connected through a single contiguous transmission system.[3]

3.2
security
<of an electric power system> ability of an electric power system to operate in such a way that credible events do not give rise to loss of load, disruption of physical integrity of equipment, stresses of system components beyond their ratings, bus voltages or system frequency outside tolerances, instability, voltage collapse, or cascade tripping

Note 1 to entry: This ability can be measured by one or several appropriate indices.

Note 2 to entry: This concept is normally applied to bulk power systems.

Note 3 to entry: In North America, this concept is usually defined with reference to instability, voltage collapse and cascade tripping only.

[SOURCE: IEC 60050-617:2009 [4], 617-01-02, modified – The words "disruption of physical integrity of equipment" have been added.]

3.3
stability and security assessment
<of an electric power system> assessment that judges and analyses whether the requirements of power system stability and security are satisfied

Note 1 to entry: Stability and security assessment includes: verifying that the operating conditions are met, checking the system's ability to withstand disturbances, and determining a margin for which the deviation of selected variables or parameters that can be tolerated without causing the system to become unstable or insecure.

3.4
stability and security quantitative assessment
<of an electric power system> assessment that judges and analyzes quantitatively whether the requirements of power system stability and security are satisfied

Note 1 to entry: Stability and security quantitative assessment includes: providing the degree to which the power system meets these requirements or identifying the differences (margin) between the actual values and the critical values for instability or insecurity.

3.5
state-based index
<of an electric power system stability and security assessment> quantitative index of stability and security, which exclusively considers the given power system state based on the characteristic and theoretical critical values that indicate instability or insecurity

Note 1 to entry: Power system state refers to: (1) steady state, the initial operating condition(point) of the power system subjected to a disturbance; (2) dynamic state, the response (variables variation) of the power system to a disturbance.

3.6
distance-based index
<of an electric power system stability and security assessment> quantitative index of stability and security, which considers the margins of power system operation parameters (based on power flow) constrained by stability and security, such as margins of load, generation amount, transfer power, and other relevant factors

Note 1 to entry: Here, the distance means the deviation (gap) from the given power system operation parameters (point) to the boundary of power system operation parameters (point) constrained by stability and security.

3.7
control-based index
<of an electric power system stability and security assessment> quantitative index of stability and security, which considers the control parameters constrained by stability and security, such as the critical clear time (CCT) of faults and the necessary (indispensable) control action to maintain stability and security

3.8
risk-based index
<of an electric power system stability and security assessment> quantitative index of stability and security, which accounts for the risk associated with stability and security

3.9
risk
<of an electric power system> combination of the probability of contingency occurrence and its impact

Note 1 to entry: Risk assessment may take into account the likelihood of implementing stability control measures and their associated costs in response to the contingency, especially if the impact of the contingency cannot be quantified directly.

3.10
rotor angle stability
<of an electric power system> ability of interconnected synchronous machines in a power system to maintain synchronism under normal operating conditions and to re-establish synchronism after experiencing disturbances

3.11
voltage stability
<of an electric power system> ability of a power system to sustain steady state voltages across all buses within the system following disturbances

4 Classification of power system stability and security

4.1 Classification of power system stability

The classification of power system stability should consider the following factors:

– the physical manifestation of instability, as indicated by the power system variables where instability is observable;
– the size of the disturbance to be analyzed, which affects the approach for calculating and predicting stability;
– the devices, processes, and timeframe required for stability assessment.

Figure 1 illustrates the classification of stability in power systems with a high penetration of power electronic interfaced technologies, delineating categories and subcategories.

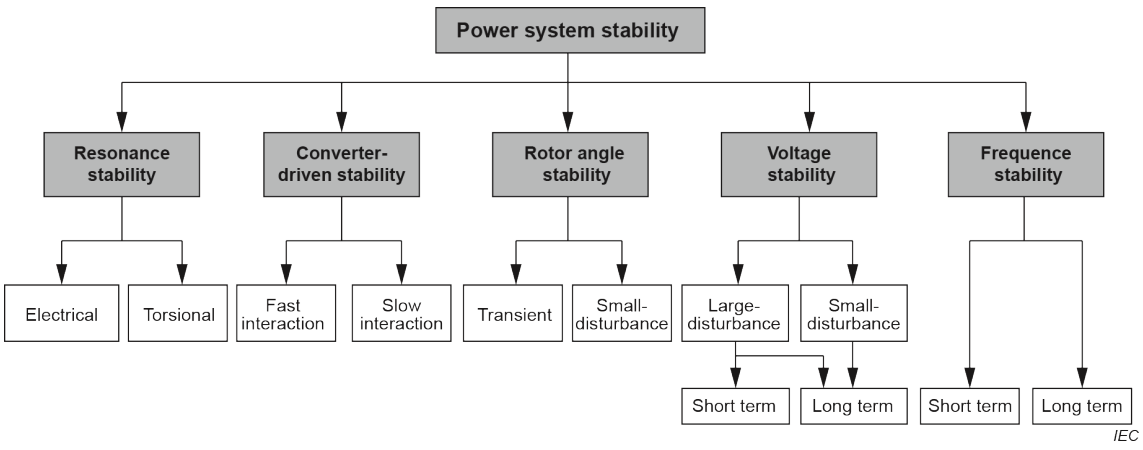


Figure 1 – Classification of stability in power system with high penetration of power electronic interfaced technologies [1], [2]

4.2 Classification of power system security

The classification of power system security is determined by the following criteria:

a) capability to withstand disturbance(s): the system's ability to endure disturbances and return to an acceptable state following a contingency;