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Dynamic characteristics of inverter-based resources in bulk power systems – Part 4: Behaviour of inverter-based resources in response to bulk grid faults

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DYNAMIC CHARACTERISTICS OF INVERTER-BASED RESOURCES IN BULK POWER SYSTEMS –

Part 4: Behaviour of inverter-based resources in response to bulk grid faults

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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 Report is English.

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A list of all parts in the IEC 63401 series, published under the general title *Dynamic characteristics of inverter-based resources in bulk power systems*, 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

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INTRODUCTION

Wind turbines and photovoltaic based power sources employ power electronic converters. Their controllable characteristics significantly change the behaviour of the power system to bulk grid faults, which brings new challenges to the reliability and safety of the modern power systems. Relay protection plays a key role in safe and stable operation of power systems for identifying and isolating faults quickly and reliably.

Relay protection operates on electrical characteristics when a fault occurs. Legacy protection principles are generally based on the fault characteristics of the synchronous machine. With the large-scale integration of these inverter-based resources (IBRs) into power systems, the diversity in IBR topologies and control strategies makes the fault behaviour turn to complex, and the electrical characteristics in the faulted power systems are significantly changed from the traditional. Legacy relay protections could be negatively affected.

Considering these challenges, this technical report aims at presenting the fault behaviour of IBRs in different topologies and control strategies, and then evaluating the adaptability of existing relay protection principles in IBR scenarios. In this report, IBRs are generally classified as full-scale converter based IBR (including Type-IV wind turbine and PV inverter) and Type-III wind turbine (also referred to as doubly-fed induction generator based wind turbine).

DYNAMIC CHARACTERISTICS OF INVERTER-BASED RESOURCES IN BULK POWER SYSTEMS –

Part 4: Behaviour of inverter-based resources in response to bulk grid faults

1 Scope

This part of IEC 63401, which is a technical report, mainly focuses on the fault behaviour of IBRs and performances of the existing relay protection in grids with large-scale integration of IBRs.

This document mainly includes:

- The IBR fault current requirements in present grid codes, including the requirements of active and reactive currents in positive- and negative-sequence systems during symmetrical and unsymmetrical faults.
- Fault current behaviour of IBRs, including the current components in transient and fundamental frequency in different IBR topology and control schemes.

Adaptability of existing relay protection with the large-scale integration of IBRs, including the performances of distance protection, phase selector, directional relay and over-current protection.

2 Normative references

There are no normative references in this document.