

SIGUARD® DSA

Dynamic security assessment

At a glance

Power system stability plays an increasingly important role in system operation and planning today. Stability limits are often reached far earlier than thermal or rated limits. The growing complexity of power systems increases the risk of blackouts. Consequently, network operation cannot solely rely on data acquisition and static n-1 analyses. To support the control room personnel, the margin to instability must be determined continuously and foresightedly, and remedial actions must be proposed to the operator.

SIGUARD® solutions offer a highly customizable online power system stability assessment. It serves as situational awareness system all the way to operator guidance and assistance.

The challenge

Reliable electricity supply is the backbone of modern societies. The dependency of economic, industry and public sectors on uninterrupted power supply is tremendously high. At the same time the risk of blackouts is increasing due to a change in power system development, which can be observed in almost any country of the world. This change is characterized by growing load demand, distributed generation, renewable energies, liberalization, smart grid technologies and new transmission equipment. Due to these changes, power systems operate closer to stability limits. Simultaneously, the number of active elements and possible remedial actions in case of stability problems are increasing.

In fact, this has already been recognized by most regulating agencies, and as a consequence of large blackouts an increase of situational awareness has been claimed.

To correctly assess a power system's stability, the operator needs to know the stability margin and have assistance during the decision making process when it comes to finding the most sufficient solution in case of stability problems.

Our solution

SIGUARD® solutions support the system operator in this decision making process. The basic idea is to perform an automatic, intelligent security assessment.

SIGUARD® DSA

Dynamic security assessment (DSA) is part of SIGUARD® solutions. It is the heart of the model-based system analysis. Its main focus is an online application to support the system operator in taking critical decisions. The extremely fast power system simulator running in the background can be executed on a computation cluster and, hence, is able to perform a comprehensive contingency study of the largest existing networks.

The contingency study cycles automatically, taking the most current snapshot from the SCADA system as the basis. The results from this study are analyzed and presented to the user. The procedure of intelligent results analysis is based on the experience of

power system dynamics experts and is customized to suit the specific needs and technologies of different power systems.

SIGUARD® DSA considers all possible stability phenomena, such as:

- voltage stability
- transient stability
- small signal stability

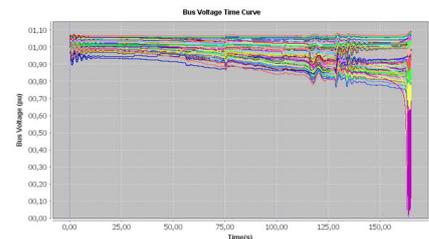


Figure 1: Long term stability simulation with final voltage collapse.

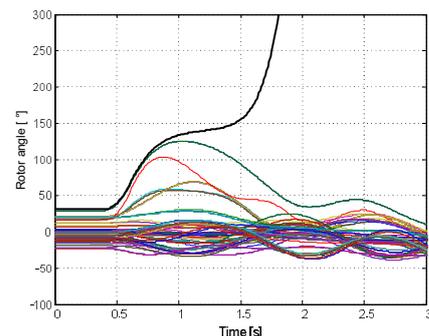


Figure 2: Transient stability after severe fault, a generator becomes unstable and is separated from the synchronous group

By considering short term forecasts of loads, generation and switching actions, SIGUARD® DSA can even prepare for future situations, leaving more time for the operator to study the situation and the proposed remedial actions.

Automatic case creation

In many cases the power system models in SCADA/EMS systems are simplified and don't reflect the level of details needed for stability assessment. The state estimator snapshot only contains the topology and the power flow data. DSA automatically adds all the relevant dynamic data such as machine and controller data. It is also able to change topological data like adding block transformers, auxiliary loads or other details. It even can disaggregate generators according to their type of primary energy like wind, solar or biomass. Of course, all the changes are performed without changing the power flow solution coming from the state estimator.

Consideration of protection devices

In more than 50% of the past blackouts, the protection system was part of the event. Protective devices can lead to cascading outages of multiple network elements. Such events can only be observed in dynamic security assessment if the protection devices are modeled for simulation in time domain.

Visualization

The displays show results of the assessment in multiple levels from very high aggregation to very high detail.

The operators get basic results at a glimpse whereas dynamic experts and planners can deep dive into the stability phenomena.

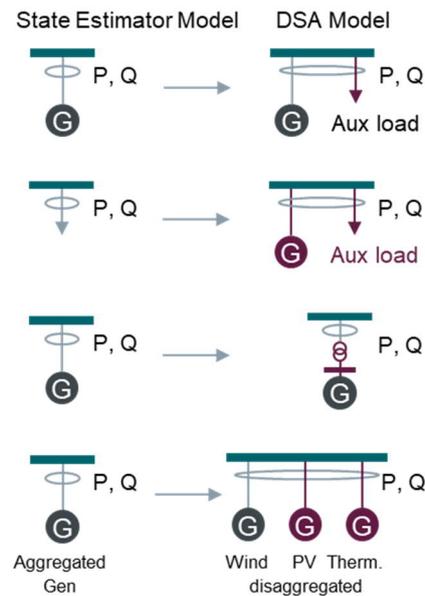


Figure 3 Automatic case creation with topology changes.

Verification of remedial actions

SIGUARD® DSA is able to verify remedial actions when stability problems are detected. The result is shown to the user immediately to assist operators during stressful system situations.

Services provided by Siemens

The SIGUARD® team offers a combination of software, training and consulting to our customers. The software forms the basis of a DSA project. To seamlessly integrate the software into the customers IT environment the following services are offered:

- on-site commissioning of all SIGUARD® software parts
- adaptation to the control room applications of any vendor
- adaptation of the power system models of any vendor to the SIGUARD® format
- adaptation to specific requirements (e.g. grid code)
- training on SIGUARD® solution topics, such as:
 - power system dynamics
 - voltage stability assessment
 - transient stability assessment
 - small signal stability assessment
 - handling of SIGUARD® software components

In addition, we provide ongoing support for grid studies regarding special protection schemes, remedial actions, power system and protection planning.

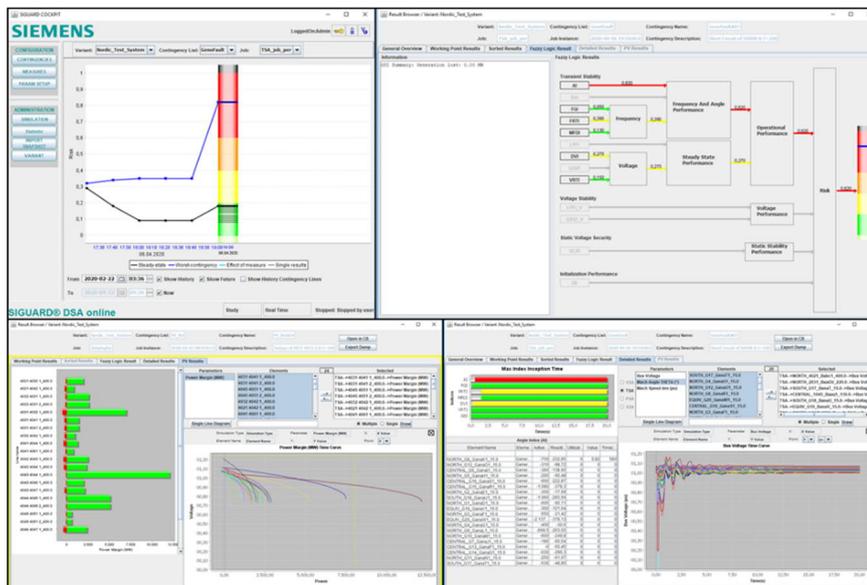


Figure 4 Examples of SIGUARD® DSA displays

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