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Compliance monitoring in the EU: Family definition and validity of certified simulation models

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1.- Family Definition and it's implications

2.- What's behind validated simulation models

3.- EU Level certification procedure

4.- Existing IGD on compliance monitoring

1. Family Definition and it's Implications

Overview

What it is and why it's important?

- This definition is used to state compliance of a group of similar units as long as they share basic characteristics and are ***within a predefined power range***.
- This definition defines ***HOW MANY units need to be tested*** to obtain certification/compliance documentation from a qualified body.
- This applies to **UNIT** certifications and declarations, **not PLANT** certifications

What's the issue?

- No common definition exists for EU member states
- Increased testing can make the process too long/too expensive → only possible to sell in High volume markets

1. Family Definition and it's Implications

Proposal and Examples

Proposed definition

Generating modules are considered in the same family as long as they share the following characteristics:

- Same unit controller make/model
- Same or greater Unit controller software version (with no changes on functions for grid parallel operation)
- Same AVR make/model and same or greater software version (with no changes on relevant functions)
- Same simulation model
- The brand (manufacturer), construction (salient pole or round rotor) or excitation system (static, rotating, permanent magnets, etc) associated to the synchronous generator is not relevant for this definition because the active and reactive power response of the unit solely depend on the unit's controller and AVR.

Power range definitions:

- **DE***: from $1/\sqrt{10} P_{tested}$ to $\sqrt{10} P_{tested}$ → **Aprox 1/3 x P_{tested} to 3 x P_{tested}**
- **ES****: **±25% P_{tested}**

2. What's behind validated simulation models

Background

How are models validated for FRT simulations?

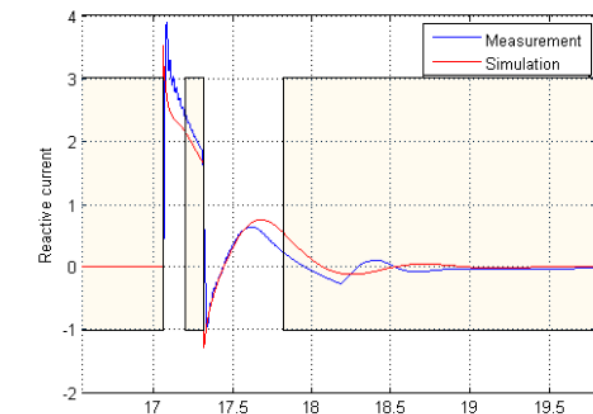
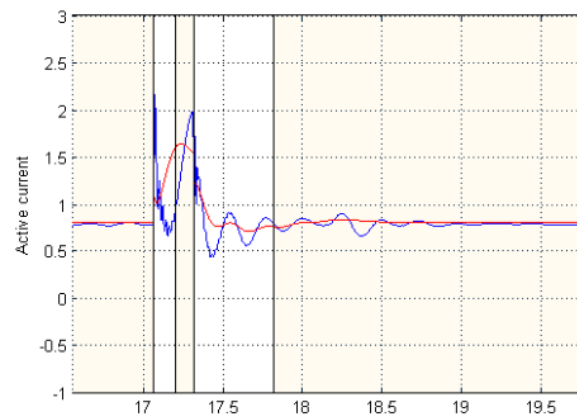
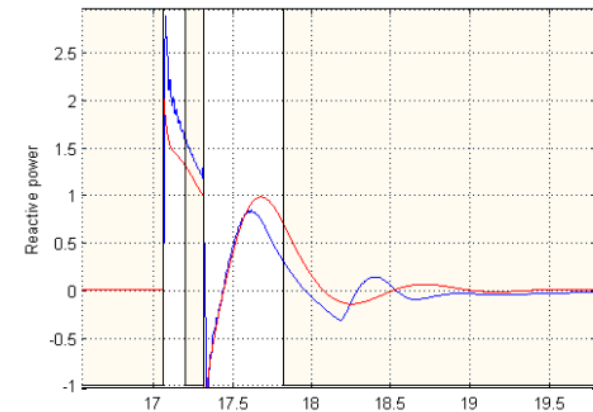
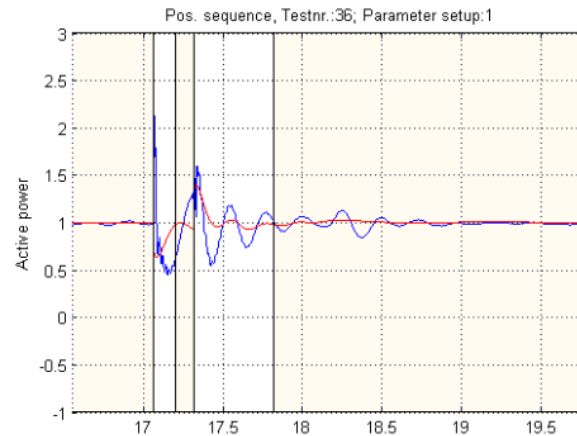
- FRT tests are performed on a unit using a special container
- Measurements are taken by an independent and accredited laboratory
- Several profiles are tested (different voltage drops and clearing times, e.g. 75%, 50%, 30% Un drops for 150 ms or 250 ms) both for UVRT and OVRT for symmetrical and asymmetrical faults
- Simulations are performed for each tested case with the SAME simulation model and SAME parametrization
- All simulations need to be within predefined limits
- Limits defined by DE guidelines (TR's) have been used **with success** for the past 7 years)

2. What's behind validated simulation models

Simulation vs Test (50% Un drop, full load example)

To consider

- Simulated behavior as seen in test
- Model can be used to study stability
- Requirements like voltage support and active power recovery can be studied



2. What's behind validated simulation models

Simulation vs Test – What it means to be within limits

Type 1 PGU		Positive, negative and zero phase sequence system											
		P			Q			I _w			I _b		
		MXE	ME	MAE	MXE	ME	MAE	MXE	ME	MAE	MXE	ME	MAE
Allowable threshold	Pre	0.150	±0.100	0.120	0.150	±0.100	0.120	0.150	±0.100	0.120	0.150	±0.100	0.120
	Fault	0.500	±0.130	0.300	0.550	±0.280	0.380	0.700	±0.300	0.630	0.510	±0.290	0.350
	Post	0.500	±0.150	0.170	0.790	±0.150	0.220	0.530	±0.150	0.170	0.760	±0.170	0.220

Table 5–4: Allowable thresholds for Type 1 PGUs

Overall Status:		Mitsystem											
TRUE		P			Q			Iw			Ib		
		MXE	ME	MAE	MXE	ME	MAE	MXE	ME	MAE	MXE	ME	MAE
Bewertet	Pre	0,033	0,012	0,014	0,005	-0,002	0,002	0,039	0,022	0,022	0,004	-0,001	0,002
	Fault	0,000	0,007	0,215	0,000	-0,273	0,167	0,000	0,182	0,233	0,000	-0,212	0,109
	Post	0,179	0,019	0,034	0,394	0,045	0,073	0,164	0,024	0,036	0,305	0,036	0,058
Status:		TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

2. What's behind validated simulation models

Simulation vs Test – What it means to be within limits

Passing an FRT test implies compliance?

- **Not directly**; many factors have an influence on the results:
 - Site short circuit power at PoC
 - Characteristics of electrical equipment on site (Transformers, cables, generators)
 - Fault condition can differ (symmetrical/asymmetrical fault, general pre-fault and post-fault conditions for module loading and power factor)
 - It can be a multi unit scenario
- Each grid connection needs **unique stability analysis** performed via simulations to take into account all relevant characteristics
- Additional tests with other FRT profiles **will NOT influence** the model and will only represent an additional (very high) cost
- A **VALIDATED MODEL** can be used to study **ANY scenario**
- Models that have been validated by a EU member state **should be accepted in other member states**.

3. EU Level Certification Procedure

- **What do we need?** Find a common certificate among EU member states to minimize costs while verifying compliance
- **What would it include?**
 - Common agreement on dealing with firmware updates and associated documentation to be delivered
 - A guideline that all certifiers use for the certification of conformity in all EU countries
 - Clear definition on how to assess if the tests are done correctly and the results can be trusted (third party laboratories, checking of results by certifier, module level certification, plant level certification, auxiliary certifications)
 - Single representative type test per category according to Type (A, B, C, D)
- **What do we have TODAY?** Compliance testing and monitoring varies between countries: from manufacturer DoCs to simulation and testing reports performed in house to third party certificates (great cost differences)

4. Existing IGD on compliance monitoring

- Original IGD released on March 2017
- The document summarizes requirements for Compliance Testing (CT), Compliance Simulation (CS) and Compliance Monitoring (CM)
- The document contains a clear list of testing and simulations required per module Type
- **The document lacks** guidance on the treatment of families, validity of certification at EU level and limits to validate simulation models
- **Using German TR's as guidelines** can be an advantage because many manufacturers already follow them.
- An update of this IGD is recommended to cover the issues identified