European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out

TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	TCMG
Title	Transient Control in Microgrids
ERIGrid Reference	**02.008-2017**
TA Call No.	2

HOST RESEARCH INFRASTRUCTURE			
Name	**SINTEF Energi AS, Trondheim**		
Country	**Norway**		
Start date	**21.09.2017**	**Nº of Access days**	**14**
End date	**23.10.2017**	**Nº of Stay days**	**33**

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Organization	
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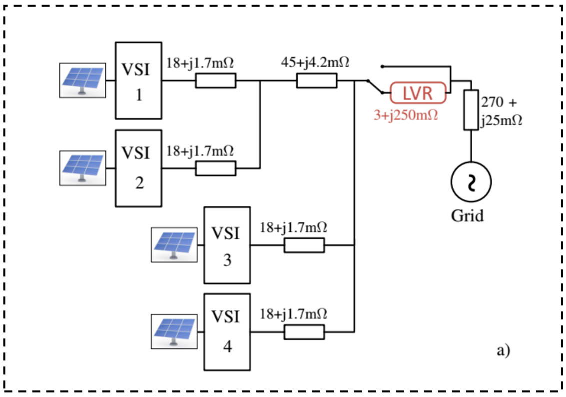
1. USER PROJECT SUMMARY (objectives, set-up, methodology, approach, motivation)

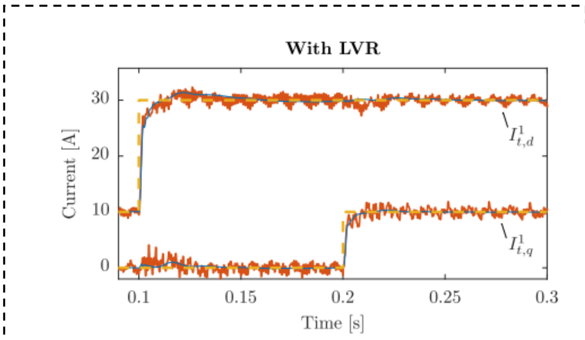


The focus of the proposed research lies on transient control in weak low- and medium-voltage grids with a large amount of distributed generation. A novel optimization-based control design method is presented that makes it possible to tune the controllers of any number of VSIs in a single step, and guarantees closed-loop stability and performance.

A main difference compared to existing methods is that only the frequency response of the plant is required for the design. This makes it possible to use very detailed and high-order models without increasing the complexity of the design process. Common performance specifications such as rise-time, maximum overshoot or decoupling are formulated as constraints on sensitivity functions, which allows for an intuitive but powerful problem formulation. The method also makes it possible to guarantee robustness towards plant modeling uncertainties and parameter changes using a multimodel approach.

To validate the performance of the developed approach, a realistic case study of a low-voltage distribution grid with multiple photovoltaic (PV) units is considered. The method is used to tune current controllers for the VSIs of the PV units, and the results are validated in numerical simulation as well as in an experimental fashion using a three-phase power-hardware-in-the-loop (PHIL) setup at NTNU Trondheim.

2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)



The controller was implemented successfully, and the experimental results confirmed the performance obtained in simulation was realistic. The tests were vital in proving the robustness and applicability of the control design method, and to reaffirm the theoretical results obtained so far.

The experiments also revealed new possible applications of the method towards the damping of harmonic currents introduced by nonlinear effects, which were not considered in the initial design.

3. PLANNED DISSEMINATION OF RESULTS (journals, conferences, others)

The results has been submitted to IEEE Transactions in Power Electronics, which is a high-impact journal in the field. A detailed dissemination of all results will be included in the PhD thesis of Christoph Kammer, which will be accessible to the public in Summer 2018.

The thesis is also part of the SCCER-FURIES project, which is a national project comprised of many academic and industrial partners with the goal of developing new technologies and strategies to satisfy the requirements of the Swiss Energy Policy 2050. The results of the conducted experiments will be made available to all partners of the project and was presented in dedicated workshops.