# Editorial

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We have the pleasure to welcome you to the second issue of our EnergyWeb Journal, dedicated to the very hot topic of SmartGrid which designates a wide spectrum of research and development activities world-wide. From the multitude of submissions we carefully selected four very high quality works that cover the breadth of this versatile research area.

It is believed that complexities related to control of heterogeneous energy resources in the SmartGrid cannot be resolved using the conventional central control approaches, which calls for decentralization and subsequently for advanced distributed control techniques capable to stir the emergent ecosystem of renewable energy.

The economic dispatch problem is more complex and challenging in smart grids, where it is expensive and unreliable for the centralized controller to achieve a minimum cost when generating a certain amount of power. In the first paper, Jianwu Cao, Ming Yu and Leonard J. Tung propose a distributed controller based on consensus algorithm to solve this challenge. As opposed to the centralized approach, the proposed algorithm enables each generator to collect the mismatch between power demands and generations in a distributed manner. The mismatch in power is used as a feedback for each generator to adjust its power generation. The incremental cost of the generator is selected as the consensus quantity that converges to a common value eventually. The results are validated by simulation.

Simulations are becoming a very important research instrument in SmartGrid related research, and this is also confirmed by the second paper. The simulation technique discussed in the paper is required for comprehensive analysis of Distributed Energy Resources (DER) integration. In this context, power hardware- in-the- loop simulations are performed to emulate the energy management system of a real microgrid including a diesel synchronous machine and inverter-based sources. The results were verified at the real microgrid installation.

The next paper illustrates another important research direction in SmartGrid, which attempts to tackle the newly arising complexities by advanced control methods. The paper presents a solution to the problem of the stable voltage generating in the changing terms of environment for the double-fed induction generator. For this, the method of observer's synthesis for external, parametric and structural disturbances was used. This allows carrying out an evaluation under conditions of uncertainty, leading to disturbances adaptation with a priori unknown structure. The work presents a synthesis method of control system, which solves the indicated problem. A stand-alone wind turbine was used for a case study. To confirm the effectiveness of the proposed solution, a simulation model was developed and full-scale simulation was conducted.

The final paper in the issue, takes on another type of complexity in SmartGrid engineering, namely the system engineering and software engineering complexities. The paper proposes a novel computer aided model-based system engineering process for the design of Smart Grid applications from the initial design specification through to the validation of the control system and hardware deployment. Similarly to the first paper in the issue, the authors assume the Smart Grid to be distributed in nature with control architecture of a heterogeneous network of controllers communicating in a peer-to-peer manner. The process is supported by the SysGRID tool, which plays the role of a system configurator and device configurator following the IEC 61850 international standard guidelines. SysGRID supports system-level design of automation logic in the form of function block networks compliant with the international standard IEC 61499. The capabilities of SysGRID are demonstrated through the process of designing a distributed protection application based on IEC 61850 and the resultant validation process in a closed-loop co-simulation.

We do hope that you will share our excitement not only at the variety of topics, covered by the presented papers, but also at the variety of geographic locations where these four works have been performed, which span the United States, Spain, The Russian Republic, and Finland, reflecting the wide interest in the transformative power of the Smart Energy systems. We are certain that you will find many innovative ideas in these visionary pioneering results.