

IEEE JOURNAL ON EMERGING AND SELECTED TOPICS IN CIRCUITS AND SYSTEMS

Call for Papers

Stability and Robustness of Power Grids with High Penetration of Power Electronics

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Scope and Purpose

In modern energy systems, such as utility power grids, shipboard microgrids and data centers, the increasing use of power electronics converters has posed new challenges to the overall design of the systems. Power electronics converters play a critical role in many applications providing active power flow control to satisfy certain performance requirements. Actively controlled converter systems interact with each other in a connected overall system, causing operational concerns due to the change in system stability parameters as well as degrading robustness of the overall system.

With the extensive deployment of power electronics converters, the power system is featured with low inertia, multi-time scale operation and complex cyber coupling. Once the system operates with inner interaction or under severe conditions, the *cyber security*, *robustness*, and *resiliency* of the crucial energy systems and power grids will be affected, and the system may present safety concerns due to the heavy reliance on power electronics. As a result, stability and robustness issues of power grids with high penetration of power electronics are worthy of study, such as:

- **Interaction and node dynamics in complex interconnected power grid:** When a large number of power converters are connected via the grid, the mutual interaction of various grid-connected subsystems cannot be avoided. To investigate the interaction of subsystems in the interconnected power grid, complex network concepts have been applied to study the connectivity, topological structure, strength of the connections, as well as other physical properties of the subsystems from a global network perspective. This special issue welcomes contributions in the application of complex network concepts in addressing the dynamics of modern power grids as well as in proposing new assessment methodologies for stability and robustness.
- **Nonlinear dynamics/reliability of the grid-connected converters:** When the power grid is subject to fault strikes, the grid-connected power converters may be working under unfavorable conditions. Submission of works related to nonlinear dynamics of the converter systems, such as the transient

stability problem and nonlinear behavior, will be encouraged in this special issue, with emphasis on application of circuits and systems principles to analysis and design. Moreover, the system reliability is degraded since the power electronics components may be working under unfavorable conditions. Although the grid-connected converters are designed to be reliable at their rated power, the electrical and thermal stresses will be increased during fault transients. Thus, latest research on the reliability of the power grid with high penetration of power electronics will be welcome in this special issue.

- **Robustness of the grid-connected system with cyber coupling:** With the development of communication networks and technologies, power converters can readily implement some form of information exchange to achieve a centralized or distributed control, which exposes the power grids to the threats of cyber-attacks. To enhance safety of the grid, IOT sensors are proposed to be attached to various subsystem in the grid. However, the introduction of IOT sensors may create new robustness issues of cyber-coupled power systems. This special issue encourages submission of novel research works on robustness of the grid considering the impact of cyber coupling.

Topics of interest

Topics of interest to this special issue include, but are not limited to:

- Data collection, case study, and analysis of impacts of high penetration of power electronics on energy systems and power grids
- Modeling and stability analysis of energy systems and power grids with high penetration of power electronics
- Multi-time-scale nonlinear oscillation analysis of grid-connected converter systems
- Nonlinear dynamics and bifurcations in energy-system integrated or grid-connected converters, including integration of PV, wind, and energy harvesting systems
- Power grid's robustness analysis from complex network's perspective
- Methods and results of robustness assessment of cyber-coupled energy systems with high penetration of power electronics
- Robustness oriented control for power grid with artificial intelligence
- Sensor technology in power grids with IOT applications

Submission procedure

Prospective authors are invited to submit their papers following the instructions provided on the JETCAS website: <https://mc.manuscriptcentral.com/jetcas>. The submitted manuscripts should not have been previously published nor should they be currently under consideration for publication elsewhere.

Important dates

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| • Manuscript submissions due | 2020-09-30 |
| • First round of reviews completed | 2020-11-15 |
| • Revised manuscripts due | 2020-12-15 |
| • Second round of reviews completed | 2021-01-05 |
| • Final manuscripts due | 2021-01-15 |
| • Target publication date | 2021-03-31 |

Request for information

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