

IEEE Control Systems Society Technical Committee on Smart Grid

The Technical Committee (TC) on Smart Grid exists to provide a forum within the IEEE Control Systems Society (CSS) for exploring dynamics, control, and optimization of responsive electricity grids. The areas of interest range from analysis and control strategies that address the increasingly complex forms of dynamic behavior, to methods for enhancing grid responsiveness through nondisruptive control of load aggregations and optimal scheduling of generation/load/storage through peer-to-peer markets. Modeling is fundamentally important, with growing reliance on resources such as inverter-based renewable generation that exhibit hybrid (continuous/discrete) dynamics. Aggregate load control requires models that capture global behavior of heterogeneous resources. Optimization

underpins economic performance and minimum-cost design, but it must cope with the nonlinearity and non-convexity inherent in power systems (along with the growing uncertainty arising from loads and renewable generation). The increasing complexity of power system dynamics, as expressed in the classification of Figure 1, calls for new analysis techniques and control strategies, with distributed control playing an increasingly important role. There is no shortage of challenging topics of relevance to CSS members.

ACTIVITIES

The TC has approximately 120 members and meets regularly at the American Control Conference (ACC) and the IEEE Conference on Decision and Control (CDC) (although meetings during the pandemic were decoupled from the conferences). The TC organizes and sponsors workshops and

invited sessions at the major control conferences, including ACC, CDC, and the IEEE Conference on Control Technology and Applications. Recent workshops have focused on “Uncertainty in Power System Dynamics” and “Scenario-Based Optimization for Stochastic Optimal Power Flow Problems.” Invited sessions have covered a wide range of topics, including networked infrastructure systems, control of distributed energy resources, machine learning applications in power system control, control strategies for sustainable and resilient energy systems, optimal control of energy systems, and grid-interactive efficient buildings. The TC has published a white paper titled “The Role of Control Systems Research in Smart Grids” and is currently working with the IEEE Smart Grid R&D Committee on an updated second edition. The TC is also looking to develop a regular series of webinars that will be

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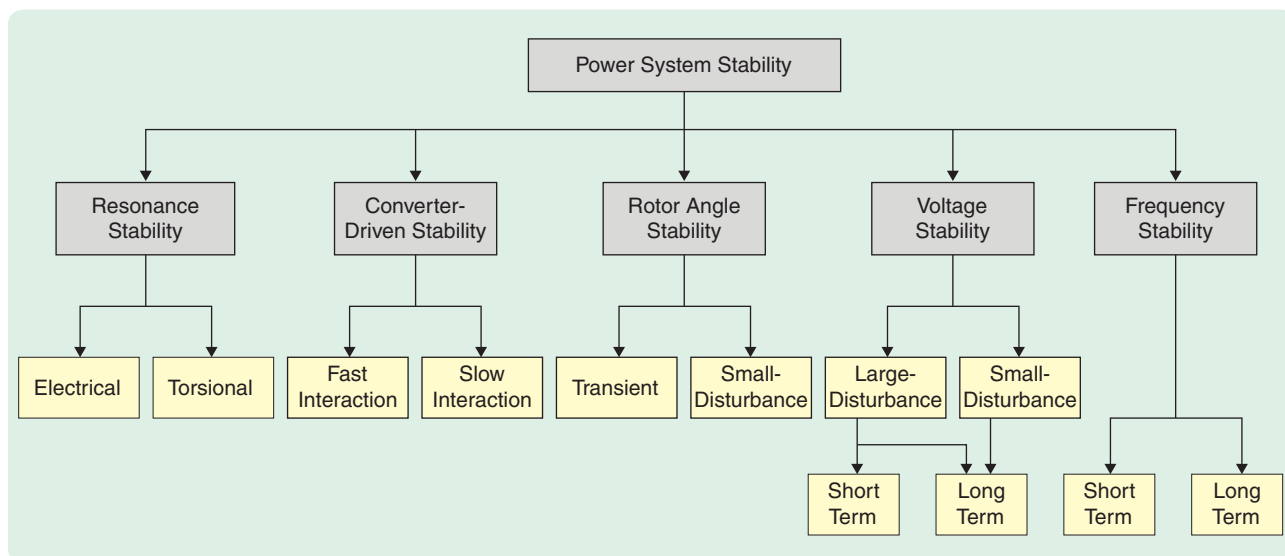


FIGURE 1 A classification of power system stability (from [1]).

available to CSS members. TC members are actively involved in numerous committees within the IEEE Smart Grid Initiative.

CSS members who are interested in joining the TC on Smart Grid are

encouraged to contact incoming TC Chair Mads Almassalkhi at malmassa@uvm.edu.

Ian Hiskens 

Technical Committee chair

REFERENCE

[1] N. Hatzigiorgiou et al., "Definition and classification of power system stability – Revisited & extended," *IEEE Trans. Power Syst.*, vol. 36, no. 4, pp. 3271–3281, Jul. 2021, doi: 10.1109/TPWRS.2020.3041774.

IEEE Control Systems Society Technical Committee on Manufacturing Automation and Robotic Control

The IEEE Control Systems Society (CSS) Technical Committee on Manufacturing Automation and Robotic Control (TC-MARC) brings together researchers and professionals who share interests on the broad area of manufacturing automation and control of robotic systems. The TC-MARC provides a valuable service to the scientific community by organizing, coordinating, and promoting scientific and technical activities that highlight recent developments for control of robotic systems, deployment of autonomous systems in challenging environments, and control and coordination of networks of robots.

As several nations witness shortages of labor and integrated circuits, together with numerous supply-chain disruptions, the focus on automation and the reliance on robots and autonomous systems have never been more important for the development of economies and to cover different societal necessities. Furthermore, recent conflicts on the world stage have demonstrated significant advantages related to the deployment and control of autonomous or unmanned systems. The adoption of modular, cooperative, and inexpensive teams of robots provides an effective and disciplined path to achieve required objectives and improve performance in different

applications. Current challenges in control of robotic systems require expertise and integration of several disciplines and research areas.

The TC-MARC is run by volunteers from academia, government, and industry. The main goals of this group are the organization of forums and meetings for technical discussion among researchers interested in the field of automation in manufacturing, control of robotic systems, and several related research topics such as autonomy, control and guidance of unmanned systems, human-robot interaction, pursuit-evasion games, and intelligent control. The TC-MARC currently has 38 members. This column summarizes recent activities of the TC.

ORGANIZATION OF WORKSHOPS AND INVITED SESSIONS

Members of the TC-MARC organized two invited sessions and two workshops at the 2021 American Control Conference (ACC). The invited session "Control, Learning, and Optimization of Cyber-Physical Systems" was organized by Prof. Yongcan Cao, M. Zhu, Dr. Eloy Garcia, and J. Lian. The second invited session for ACC 2021 was "Pursuit-Evasion and Attack-Defend Games," and it was organized by A. Von Moll, Z.E. Fuchs, S.D. Bopardikar, and Garcia. The workshop "Recent Advancement of Human Autonomy Interaction and Integration" was

coordinated by N. Jain, C. Liu, S. Mou, Y. Wang, F. Zhang, and W. Zhang, and the workshop "Fielding Legged Robots Off the Beaten Path" was led by J. Pusey, Y. Gu, and Y. Zhao. The TC-MARC was also represented within the fifth IEEE Conference on Control Technology and Applications. In such a conference, the invited session "Pursuit-Evasion and Reach-Avoid Games" was organized and chaired by Garcia and Fuchs. These events highlighted important applications and areas of research, including human-robot interaction, control of cyberphysical systems, and conflicts among unmanned autonomous vehicles.

The recent ACC 2022 was another meeting with ample TC-MARC representation. First, the invited session "Learning, Optimization and Safety in Control Design of Cyber-Physical Systems" was organized by Cao, F. Zhang, and Garcia. In addition, two preconference workshops saw participation and leadership by TC-MARC members. The workshop "Lighter-Than-Air Autonomous Agents: A Hands-On Tutorial" was coordinated by D. Lofaro, D. Sofge, H. Nguyen, S. Ravi, and F. Zhang. Finally, "Second Workshop on Human-Autonomy Interaction and Integration" was organized by W. Zhang, Liu, Mou, Wang, N. Yao, and Jain. As the title indicates, this workshop is the second in a continuing series of workshops held at the annual ACC, which have presented