Contribution ID: **50** Type: **not specified**

Scalable Grid Topology Reconfiguration using Consensus-Based Multi Agent Reinforcement Learning

Thursday, June 20, 2024 2:30 PM (30 minutes)

Power network control is a crucial aspect of modern society, as it allows electricity to be a reliable resource for daily living, industry, and transportation. Controlling electricity is a highly complex task that represents a sequential decision-making problem with large state and action spaces. The state space represents a combinatorial explosion of all possible ways the network can be reconfigured through topological remedial actions. As the power network is a real-world infrastructure that is constantly changing and needs to be acted on real-time, solutions to operate this network need to be scalable while still achieving reliable results. Additionally, similar issues occur at different grid scales, and it is beneficial to deploy a similar solution to each of these scales. In order to improve the scalability of solutions in networks with a combinatorial state space while maintaining similar performance, a multi-agent reinforcement learning approach is proposed. Here, individual agents propose actions that are evaluated by a central controller. The introduction of multiple (autonomous) agents that interact within a shared environment reduces the central computational load and improves scalability.

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Session Classification: Parallel session: Reinforcement learning for energy networks