

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

**Advancing Microgrid Protection:
Innovations in Traveling Wave
Protection**

By

Ph.D. Student Dmitrii Etingov

Today's power distribution networks, increasingly populated by distributed energy resources (DERs) and inverter-based resources (IBRs), demand protection strategies capable of handling constrained fault currents and rapidly shifting power flows. Traditional protection schemes are often found inadequate in these scenarios, highlighting the necessity for a more adaptive and efficient approach.

This dissertation presents a hybrid framework uniting Traveling Wave Protection (TWP) for microgrids with an Internet of Things (IoT) architecture, enhanced by an offline AI-based fault analysis. The new TWP scheme utilizes high-frequency transient signals for swift and accurate fault detection, classification, and localization, while sidestepping the computational overhead.

Hardware-in-the-loop (HIL) experiments on microgrid systems validate the superior performance of this novel TWP-centric solution over conventional protection schemes. Notable advancement in detection, fault localization accuracy, and computational efficiency underscore the potential of this integrated approach to meet complex demands of modern, high-penetration active distribution topologies.

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Dissertation Advisor: Prof. Peng Zhang