

## Negative Sequence-Based Protection Techniques for Microgrid Connected Power Systems

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**Abstract :** Microgrid protection presents challenges to conventional protection techniques due to the low-induced fault current. Protection relays present in microgrid applications require a combination of settings groups to adjust based on the architecture of the microgrid in islanded and grid-connected modes. In a radial system where the microgrid is at the other end of the feeder, directional elements can be used to identify the direction of the fault current and switch settings groups accordingly (grid-connected or microgrid-connected). However, with multiple microgrid connections, this concept becomes more challenging, and the direction of the current alone is not sufficient to identify the source of the fault current contribution. ORNL has previously developed adaptive relaying schemes through other DOE-funded research projects that will be evaluated and used as a baseline for this research. The four protection techniques in this study are labeled as follows: (1) Adaptive Current only Protection System (ACPS), (2) Intentional Unbalanced Control for Protection Control (IUCPC), (3) Adaptive Protection System with Communication Controller (APSCC) (4) Adaptive Model-Driven Protective Relay (AMDPR).

**Keywords :** adaptive relaying, microgrid protection, sequence components, islanding detection

**Conference Title :** ICEPSPCS 2024 : International Conference on Electric Power System Protection and Control System

**Conference Location :** New York, United States

**Conference Dates :** April 22-23, 2024