

Review of Optimization Algorithms Applied to Adaptive Protection in Smart Power Grids

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Abstract: *The rapid evolution of smart power grids, driven by increased penetration of renewable energy sources, distributed generation, and advanced communication technologies, has introduced significant challenges to conventional power system protection schemes. Traditional protection methods, designed for static and centralized power systems, often fail to maintain reliability and selectivity under dynamic grid conditions. Adaptive protection has emerged as a promising solution, enabling real-time adjustment of protection settings in response to changing system states. Optimization algorithms play a crucial role in adaptive protection by determining optimal relay settings, coordination parameters, and decision thresholds. This review paper presents a comprehensive analysis of optimization algorithms applied to adaptive protection in smart power grids. Classical, metaheuristic, and artificial intelligence-based optimization techniques are reviewed, with emphasis on their applications, advantages, limitations, and future research directions.*

Keywords: Adaptive Protection, Smart Power Grids, Optimization Algorithms