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Soliman earned his Bachelor's and Master's degrees in Automatic Control Engineering from Menoufia University, Egypt, in 2015 and 2021, respectively. He is currently pursuing a Ph.D. in Systems and Control Engineering at the Department of Control and Instrumentation Engineering (CIE), King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia, where he also serves as a Teaching Assistant. He has published numerous scientific research articles in prestigious international journals and conferences. His research interests include intelligent control systems, adaptive control, optimization algorithms, renewable energy integration, and load frequency control.



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Paper Title: Intelligent Optimization-Based Load Frequency Control for Multi-Source Hybrid Power Systems

Abstract:

The rapid rise in energy needs has put immense pressure on our power systems, particularly due to the significant reliance on renewable energy sources. It's essential to manage this increasing pressure effectively to guarantee the continuous and smooth functioning of our power grids. The balance between power generation and demand significantly influences the system's frequency, impacting its stability. Any variations in this frequency can result in over-voltage issues, grid damage, and in severe cases, complete blackouts. Consequently, this study introduced a robust method to alleviate the load frequency issues stemming from fluctuating demand with a significant increase in the use of renewable energy. The Load Frequency Control (LFC) system depends on a Proportional Integral (PI) regulator. To optimize this controller, the genetic algorithm (GA) is initially employed, followed by refinement through the firefly algorithm (FA). Improvements in how the system reacts are achieved by integrating a Fractional Order Proportional Integral Controller (FOPID) adjusted through the dragonfly search algorithm (DSA). Also, to enhance the system's effectiveness, a layered PI-Proportional Derivative (PI-PD) controller is suggested, utilizing Grey Wolf Optimization (GWO) to determine its parameters. The GWO-PI-PD controller provides satisfactory results in mitigating the LFC issue as compared to the other techniques.

Keywords: Load frequency control, Renewable energy sources, Fractional Order Proportional Integral Controller, Grey Wolf Optimization.