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Addressing ORPD problem in a standard IEEE power network accompanied with RESs and FACTs appliances by COMMKE under volatile load scenarios

Susanta Dutta ^{a,1}, Tushnik Sarkar ^{a,1}, Chandan Paul ^{a,1}, Sabbir Reza Tarafdar ^{b,1},
 Provas Kumar Roy ^c , Ghanshyam G. Tejani ^{d,e} ,
 Seyed Jalaleddin Mousavirad ^f 

^a Department of Electrical Engineering, Dr. B.C. Roy Engineering College, Durgapur, India

^b Department of Computer Science and Engineering, Dr. B.C. Roy Engineering College, Durgapur, India

^c Department of Electrical Engineering, Kalyani Government, Kalyani, West Bengal, India

^d Department of Research Analytics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, 600077, India

^e Applied Science Research Center, Applied Science Private University, 11937, Amman, Jordan

^f Department of Computer and Electrical Engineering, Mid Sweden University, Sundsvall, Sweden

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ABSTRACT

This research examines the optimal reactive power dispatch (ORPD) problem across IEEE 30 & 118 bus experimental networks. In particular, we incorporate renewable energy sources (RESs) like solar photovoltaic (PV) and wind power (WP) into the conventional network after first balancing it. Both singular and multiple objective functions (OFs) are considered here. These are, both alone and together, a drop in aggregated voltage deviation (AVD) over buses and a reduction in active power loss (APL). Twenty one cases in all have been looked at using three test frameworks. TSC-TCR (FACTs devices) with test setup are being used for cases 4–6, 9–12 & 16–21. The objectives have been achieved by the use of the COMMKE algorithm, a multi-trial vector-based monkey king evolution (MMKE) method integrated with oppositional based learning (OBL) and chaotic based learning (CBL). Comparative analysis has also been done on the performance of the other optimization methods that were showcased in the latest ORPD research. Both constant and dynamic load demand scenarios are covered in the study. Appropriate probability density functions (PDF) are used to forecast the uncertain WP, PV source, and load demand. Uncertain situations with fluctuating load demand, wind speed (WS), and sun irradiation (SI) are simulated using Monte Carlo simulations (MCS). The investigations' findings demonstrate that, in a variety of cases, the COMMKE outperforms optimization techniques found in the recent ORPD literature. The improvement of power network efficiency in ORPD difficulties by the application of TSC-TCR is another noteworthy conclusion. To scrutinize the performance of COMMKE, the identical experiments have been conducted using MMKE & driving training based optimization (DTB) and the results coming from COMMKE, MMKE & DTBO are compared. To make this comparison more lucid, statistical records are produced, box plots are presented, error bar plots are used and moreover one way ANOVA test has been performed over the results generated through the different optimization approaches.

* Corresponding author.

E-mail address: seyedjalaleddin.mousavirad@miun.se (S.J. Mousavirad).

¹ All authors contributed equally.

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