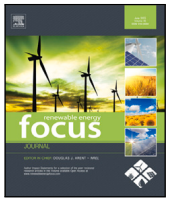
Renewable Energy Focus 49 (2024) 100573

Contents lists available at ScienceDirect

Renewable Energy Focus

journal homepage: www.journals.elsevier.com/renewable-energy-focus



Research paper

Integration of optimal power flow with combined heat and power dispatch of renewable wind energy based power system using chaotic driving training based optimization

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ARTICLE INFO

Keywords:
Chaotic driving training based optimization (CDTBO)
Combined heat and power economic dispatch (CHPED)
IEEE-30 bus
Optimal power flow (OPF)
Wind energy

ABSTRACT

Combined heat and power economic dispatch (CHPED) based optimal power flow (OPF) problem has been studied in this article using a new, practical approach based on chaotic driving training optimization (DTBO) (CDTBO). In the proposed technique (CDTBO), the chaotic based learning is integrated with DTBO to overcome the local optimal problem and inferior convergence speed of the existing algorithms. OPF is an important concern to retain the power system running effectively. In order to meet the demand for reasonably priced power generation with optimal power flow in transmission lines, the authors combined CHPED and OPF. Since fuel is changing daily in the current environment, using renewable energy sources to generate electricity economically is crucial. The renewable energy source like wind energy is integrated with thermal units for economic power generation with reducing the thermal fuel consumption of CHPED-based OPF system. The proposed technique implemented on CHPED based IEEE-30 bus system for renewable and without renewable energy sources with considering different cases. The suggested problem considering with valve point loading of thermal units, transmission losses and uncertainties of wind speed to address the non-linearity of the renewable-based CHPED-OPF system. Cost minimization, voltage deviation control, transmission losses minimization and stability index are the single objectives of the prospective system. Furthermore tested on multi-objective functions for simultaneously minimization of cost with emission and simultaneously minimization of active power loss with voltage profile. It is observed that the proposed CDTBO technique helps to reduce the cost by 2% and 12.8% for renewable based system as compared to non-renewable system for multi-objective function. The robustness of the proposed solution has been verified by implementing the statistical analysis on two systems with least variation of mean and optimal values of cost with the tolerance of less than 0.0035%. A comparison has been made with recent well known optimization techniques to address the superiority of the suggested CDTBO algorithm.

1. Introduction

Heat is released into the environment at all thermal power plants during the generation of electricity, either by cooling towers, flue gas, or some other means. The energy efficiency of power generation units drops to a very low level (between 50% and 60%) due to the byproducts produced during heating, such as NOX, SOX, SO2, and CO2. As a result, the atmosphere becomes contaminated. Problems with combined heat and power economic dispatch (CHPED) are important in power system research. The number of pollutants discharged into the atmosphere and the cost of production are reduced by using the waste heat from the steam. Chillers are used by the heat recovery steam generator in CHPED to recover heat lost during cooling and steam production. A co-generation system that produces both heat and electricity at the same time is the CHPED. CHPED raises the efficiency of thermal generating stations to above 75% even though it requires more capital.

Economic power generation was the primary emphasis of the CHPED, not transmission line power flow. Optimal power flow (OPF) in power systems is a well-studied optimization problem. This problem was first raised in 1962 by Carpentier [1]. The objective of OPF is to identify a steady state operating point that, at the same time lowering the cost of generating electricity, meets demand and operating constraints. Therefore, in order to meet the demand for reasonably priced power generation with optimal power flow in transmission

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https://doi.org/10.1016/j.ref.2024.100573
Received 14 September 2023; Received in revised form 1 March 2024; Accepted 19 April 2024
Available online 27 April 2024