



EV charging and fuel cell vehicle refuelling with distributed energy resources using hybrid approach

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Abstract

This manuscript proposes a hybrid technique for Electric Vehicle (EV) charging and Fuel Cell vehicle refuelling with distributed energy resources. The proposed hybrid approach, known as the BWO-CCG-DLNN method, combines the Beluga Whale Optimization (BWO) algorithm with the Cascade-Correlation Growing Deep Learning Neural Network (CCG-DLNN). The primary goal of the proposed strategy is to reduce reliance on the utility grid while simultaneously reducing the overall cost of distributed energy resources by using battery storage for peak shaving. The EV charging's cost is reduced using the proposed BWO approach, and the ideal outcome of the system is predicted using the CCG-DLNN approach. The proposed strategy is implemented into use on the MATLAB platform, and it is contrasted with current strategys, including the Cuckoo Search Algorithm Color Harmony Algorithm, and Particle Swarm Optimization, The proposed method demonstrates the lowest mean (1.0936) and median (1.0158), indicating its effectiveness. The standard deviation (0.1505) suggests relatively consistent results. The proposed method shows better result when compared to other methods. When compared to other existing approaches, the proposed approach has a high efficiency of 98% and a low cost of 200 (\$/kW).

Keywords Electric vehicle · Fuel cell vehicle · Distributed energy resources · Hydrogen storage tank · Photovoltaic · Utility grid · Battery storage system · Renewable energy systems · Electrolyser

1 Introduction

The demand for energy keeps rising as technology develops. However, the reliance on fossil fuels as the main energy source is problematic due to the negative environmental effects and limited storage capacity (Tao et al., 2020). It is crucial to urgently explore alternative energy sources. Renewable energy shows great promise as it is sustainable and abundant like solar and wind energy (Zhou et al., 2023). However, a test with these renewable sources is their intermittent nature, dependent on climate conditions. Consequently, to provide a consistent and sustainable power supply, energy storage devices are commonly integrated with renewable energy sources like batteries or dependable energy sources like FCs

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