Scholar Publishing Group
Academic Journal of Energy
https://doi.org/10.38007/RE.2020.010403
ISSN 2790-2714 Vol. 1, Issue 4: 26-34

Compound Energy System Based on Time Series Algorithm

Kumar Vijayakumar*

University of South Wales, Australia

**corresponding author*

Keywords: Timing Algorithm, Compound Energy, System Optimization, Algorithm Improvement

Abstract: Today, with the continuous progress and development of society, the demand for energy is increasing. This has led to a series of serious problems such as the shortage of fossil fuels and the deterioration of environmental pollution. For this reason, the country has also attracted much attention and strives to achieve energy conservation and emission reduction as much as possible. been studied. focus. The purpose of this paper is to optimize complex energy systems based on time series algorithms, and to establish mathematical modeling and solution design of complex energy systems. Because traditional time series algorithms often convert multiple objectives into one objective to solve, there are many optimal solutions. However, the traditional time series algorithm has local convergence, so it is proposed to introduce the normal distribution crossover operator in the traditional time series algorithm to enhance the search ability of the algorithm. Through example analysis, the water supply temperature is fixed at 50 ℃ in real life. The total energy efficiency ratio COP after system optimization is 5.7-6.1, which fully reflects the energy saving effect after optimization. Environmental protection and economic concepts, and the feasibility of improving the timing algorithm to optimize complex energy configuration parameters.

1. Introduction

The advancement of society is premised on the consumption of energy. Human society has a long history in the utilization of energy, from the earliest firewood to the most widely used coal, oil, and various green energy sources that have attracted much attention. In the history of energy changes, the level of productivity has continued to improve, and human civilization has continued to progress [1]. Energy is a necessary material for modern development, and it is closely related to the national economy and people's livelihood. At present, human society has ushered in another wave of energy changes. Under such a background, how to build a safe, reliable, clean,

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environmentally friendly, cost-effective composite energy system is one of the important and urgent problems facing governments [2].

At home and abroad, the social and economic benefits of the composite energy system are better, and it is an important development direction in the global energy supply mode. Bouchain A introduced a sparse signal model using changes in engine speed. It is determined by the OMP algorithm corresponding to the model. Results on synthetic and real signals are presented to demonstrate the effectiveness of the method, including a real blade fracture test case. The main advantage of the proposed method is that it provides accurate estimates and is much less computationally expensive than existing methods. Furthermore, the method does not require the determination of precise statistics, while taking into account the speed differences of the machines [3]. Kishore V proposed a blind time synchronization algorithm in DC-biased Optical Orthogonal Frequency Division Multiplexing (DCO-OFDM) systems based on signal cycle stability relying only on second-order statistics. It doesn't require any channel sampled responses because it's a blind calculation. The performance of the proposed calculator is evaluated using computer simulations in Visual Lab software and verified by experimental results obtained on a VLC test bench using Universal Hardware Radio Peripheral (USRP) software [4]. Singh K invented a digital clock algorithm for fast scintillator detectors such as LaBr3, BaF2 and BC501A. Signals were collected using a CAEN 250 mega per second (MSPS) and 500 MSPS digitizer. Obtain zero-crossing (TM) timestamps using the Digital Fractional Time Constant (DCF) method. Accurate time information is obtained using cubic spline interpolation of sample points in the DCF time domain. For better time-of-flight (TOF) resolution, DCF parameters are optimized for each detector pair [5]. It can be seen that the composite energy system has achieved rapid development at home and abroad, and the optimization of the composite energy system has also become a hot research topic at home and abroad.

The composite energy system is an excellent solution for dealing with environmental pollution, resource scarcity and other problems, but there are still some problems to be solved in the process of its promotion to practical application, such as the economic benefits of the composite energy system, energy Utilization, and how to achieve a balance between them is a problem that needs to be solved urgently. The optimal operation of complex energy systems can effectively improve energy utilization and system reliability, which is of great significance to the economic, environmental protection and reliable operation of the entire system. In-depth research and analysis of the composite energy system is of great significance for finding the balance point between the indicators of the composite energy system and using appropriate multi-objective optimization algorithms to deal with the optimization problem of the composite energy system. Practical value.

2. Research on Optimization of Compound Energy System Based on Time Series Algorithm

2.1. Composition of the Composite Energy System

(1) Solar collector

A solar collector is a device that converts the energy of solar radiation into heat and transfers the heat to a heat transfer medium. The scattered solar radiation needs to be concentrated, so the receiver will become the most important part of the solar thermal utilization system [6-7]. At present, there are many classification methods for solar collectors. The system established in this paper uses evacuated tube collectors. A brief introduction. The vacuum collector is a component that evacuates the space between the heat sink and the transparent cover. Its main features are: high heat collection efficiency, good antifreeze performance, small heat capacity, relatively fast start-up

It has the advantages of being able to operate under pressure [8-9].

(2) Air source heat pump

It mainly uses the air, which is always present in nature, as the main source of thermal energy, while another small part relies on the operation of the electric driven compressor for power transfer. It transfers low-quality thermal energy from air to hot water at the expense of relatively little electrical energy. It works as follows: the heat of the ambient air is first collected by the evaporator, and then the heat is transferred out. It is compressed into high temperature and high pressure gas by the compressor, and then condensed into water by the condenser, and the heat released at the same time provides heat for the heat user. The working water becomes low-temperature and low-pressure water again, and enters the evaporator for removal, etc. According to the Carnot cycle, the heat energy of the heat source is always generated [10-11].

(3) Electric boiler

An electric boiler is a mechanical thermal energy device that generates resistance or electro-sensitive heat based on electricity. When the heating medium water is heated to a certain temperature by the boiler and pressurized, it can generate the same thermal energy device as the energy generated. When the electric boiler is in the heat storage stage, the electric water supply valve is opened to supply water to the hot water storage tank. After 60 seconds, the circulating water pump stops working again. The operation of the water pump is mainly based on the set frequency. After half a minute, the electric boiler starts working and keeps the heat [12-13].

2.2. The Principle of Microsoft Timing Algorithm

Time series forecasting methods make forecasts by analyzing time series data and understanding how it changes over time. A time series is a sequence of numbers formed by consecutive observations of the same phenomenon at different times. It is an ordered collection of measurements collected periodically. The following collections represent:

$$\{X_{t-1} = \langle t_1, a_1 \rangle, X_{t-2} = \langle t_2, a_2 \rangle, \cdots, X_{t-n} = \langle t_n, a_n \rangle\} \quad (1)$$

where ai is the value of the variable at time ti. Time series analysis can quantitatively reveal a mathematical model of the dynamic relationship involved in the growth and change of a phenomenon [14-15].

2.3. Improvement Based on Timing Algorithm

In the evolution process, the method chosen for the time series algorithm is SBX, which simulates the crossover process of binary operators. Therefore, in this section, in order to make up for the shortcomings of the SBX operator, the normal distribution is introduced into the crossover operation, thereby expanding its search ability. The normal distribution crossover (NDX) operator is [16-17]:

$$c_{1/2,i} = (y_{1,i} + y_{2,i})/2 \pm \beta(y_{1,i} + y_{2,i})/2 \quad (2)$$

In the formula: C1/2,i is the corresponding i-th variable on the sub-chromosome, and N(0,1) is a normally distributed random variable.

By introducing the NDX operator into the time series algorithm, the range will be increased accordingly, avoiding the problems of local optimization and unstable evolution process. Diversity can also be preserved, and the quality of Pareto optimal solutions can be improved accordingly. Using advanced algorithms to solve multi-objective power system optimization problems can provide as many and representative solutions as possible to make rational decisions [18].

3. System Optimization Model Based on Time Series Algorithm

3.1. Algorithm Model Establishment

The purpose of establishing the timing algorithm optimization model is: on the premise of ensuring the minimum operating cost of the system, by coordinating and optimizing the comprehensive energy system, the utilization rate of renewable energy can be further explored, and the network can be optimized to make it have rapid dynamic optimization. Based on the optimal output action, the optimization strategy of the integrated energy system can be formulated to reduce the redundancy of the network as much as possible, thereby reducing the operating cost of the system.

Under the set control strategy, the constraints of the algorithm include load supply and demand balance constraints, power generation, output power balance constraints, energy storage element charge and discharge constraints, and interaction energy consumption balance with external power grids. Kov decision to determine the best sequence, and combined with convolutional neural network to gradually obtain the target set with the smallest reward value.

3.2. Establishment of the Objective Function

The overall goals of the integrated energy system optimization include: the number of charging and discharging times of the energy storage unit crossing the line and the information interaction between the integrated energy system and the external power grid. The penalty cost for crossing the line is to reduce the system cost as much as possible on the basis of taking into account the goals. The objective function is established as follows, where the power transmission cost:

$$\triangle f_{flow} = \sum_{i=1}^{N} P_i^2(t) \tag{3}$$

Among them, Pi is the output power of each generator.

3.3. Autoregressive Trees

The model established by the time series algorithm is an autoregressive tree model, and each leaf represents an independent autoregressive model.

Figure 1 shows the autoregressive tree model, where each non-leaf point in the decision tree must refer to a Boolean regression type designation. Each leaf surface is obtained by combining the corresponding intermediate nodes layer by layer, which is expressed in the form of AR(p).

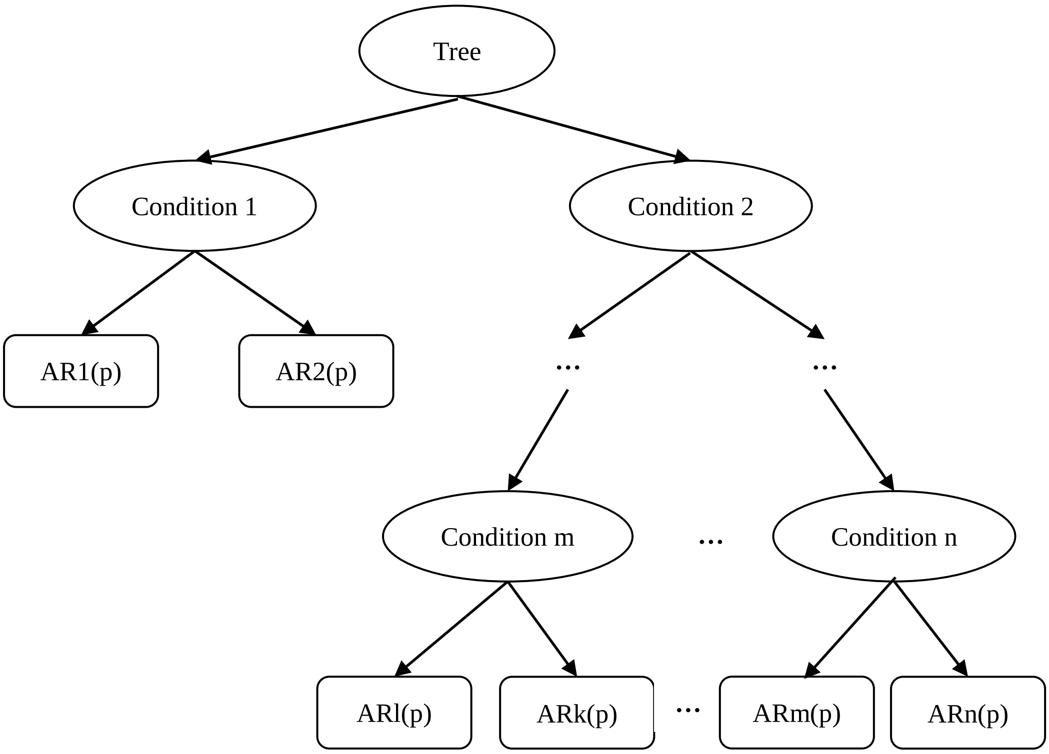

Figure 1. Autoregressive tree model

4. Research on System Optimization Analysis Based on Time Series Algorithm

4.1. Comparison of Energy System Heating

The water supply temperature is constant at 50 ℃ in practical life to prove the correctness and applicability of the optimization results. The actual data of compound energy heating are shown in Table 1.

Table 1. Hybrid energy system operational data

Ambient temperature/℃	-4.4	-1.2	-1.5	-2.9	-4.5	-2.1	-3.6
Total system heat gain/w	9678.5	9840.4	8923.4	9834.5	8934.5	9745.2	8798.4
System power consumption/w	1839.2	1839.4	1903.2	1930.5	1830.5	1930.5	1900.3

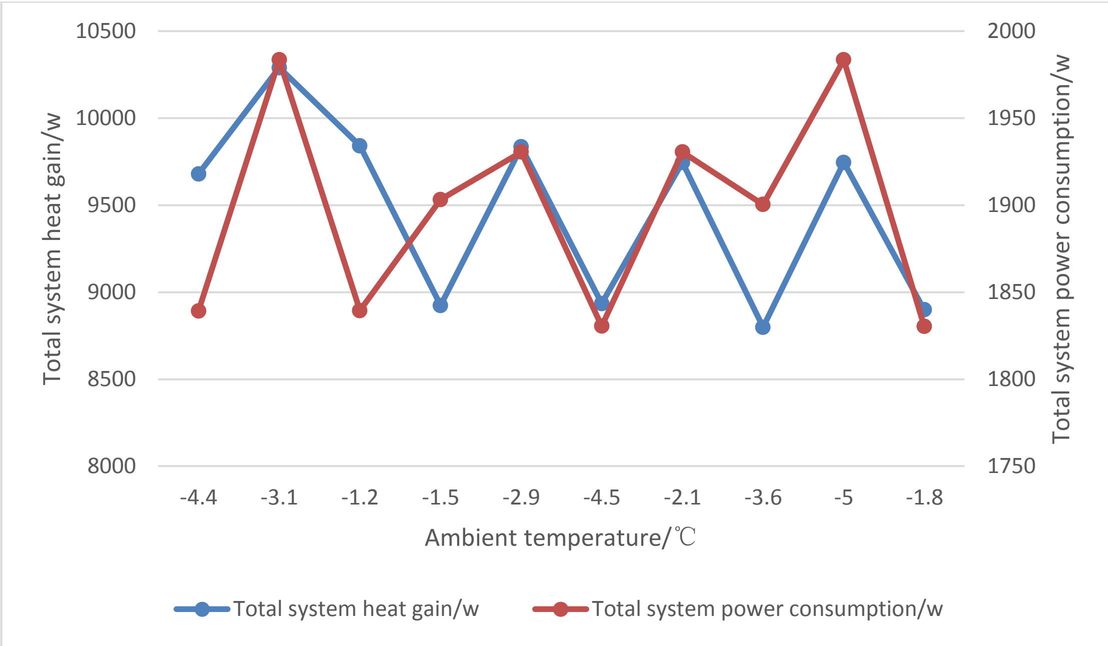

Figure 2. Comparison of operation data of composite energy system

From the data in Figure 2, it can be found that the total heat gain of the optimized data system is relatively improved under the same ambient temperature, and the total energy efficiency ratio of the system is relative to the actual data. Therefore, the improved time series algorithm is used to solve the composite energy system, which can improve the utilization rate of energy and provide better heating for heat users.

4.2. Comparison of COP Energy Efficiency

The specific distribution is shown in Table 2.

Table 2. Comparison of system COP energy efficiency ratio before and after optimization

Serial number	1	2	3	4	5	6	7
Optimized	6	6	5.7	5.7	5.9	6.1	5.8
Not optimized	5.6	5.5	5.4	5.6	5.5	5.6	5.4

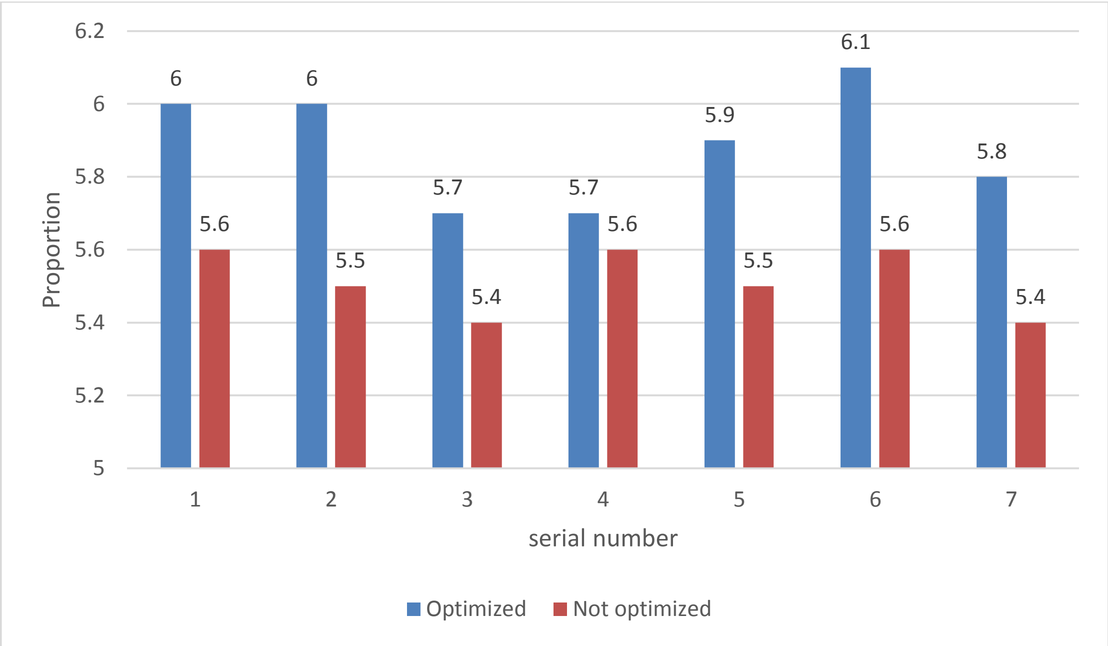

Figure 3. Comparison chart of system COP energy efficiency ratio before and after optimization

From Figure 3, we can find that when the ambient temperature is the same, the optimized composite energy system is significantly higher than the actual system that has not been optimized. The total energy efficiency ratio of the optimized system is COP. In 5.7-6.1, and the feasibility of the improved timing algorithm to optimize the configuration parameters of compound energy is also explained.

5.Conclusion

This paper studies the optimization problem of complex power system, in order to make full use of the technology of complex power system and give full play to the energy compatibility and supply-demand compatibility of complex power system. It provides theoretical support and reference for the practice of coordinated optimal operation of the energy system. However, theoretical research and simulation analysis are carried out on the subject of compound energy system. Due to the limitation of time, the article inevitably has some shortcomings, mainly manifested in the composite energy system in the paper, which has a relatively simple structure, and does not consider the line loss correction and energy supply delay of the system. Therefore, the calculation of energy flow is There may be some errors.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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