Control System of Wind Power Generation Based on Artificial Intelligence Technology

Y Wang

CSIC (Wuhan) Lingjiu Electrical Technology Co.Ltd, Wuhan, Hubei, 430074, China
Email: huanwu@36haojie.com

Abstract. In order to improve the intelligence and production efficiency of the wind power generation control system, a wind power generation control system based on artificial intelligence technology is proposed. The paper describes the overall features of the scheme in detail, analyzes and discusses the core technology of the scheme, and expounds the concrete realization process of the scheme. The results show that the scheme can improve the intelligence of the wind power generation control system, and improve the productivity and benefit of the wind power generation automatic control system.

Keywords. Automatic control system; Wind power generation; Artificial intelligence technology; High and new technology; Intelligence system

1. Introduction

The wind power generation, with the characteristics of cleanliness, non-pollution and renewability, is received warmly and universally throughout the world, especially, Netherlands, in contemporary society, China becomes to realize that the wind power generation can bring a good supply of benefits for citizens, and change exceedingly the lifestyles of overwhelming majority of private individuals, therefore, at present, experts and professors in China seek to find the way of the improvement of the automatic control system of wind power generation in productivity and effectiveness, to ameliorate the present situation of the usage of the automatic control system of wind power generation, as a consequence, the paper figures out an ingenious construction method of the automatic control system of the wind power generation based on artificial intelligence technology, and comes up with detailed application methods.

2. Theoretical Basis

2.1. Artificial Intelligence Technology

At present, the advancement of Internet has been putting on vastly fast track, almost everyone has a personal computer, moreover, a variety of intelligence technology appear on citizens’ daily life, which can combine organically with other intelligence technology, such as big data technology, cloud computing technology and so on, furthermore, can also include a good supply of intelligence technology, in other words, is an organic integration of a variety of high and new technology, such as respectively, expert system technology, differential geometry technology, adaptive control technology and artificial neural network technology, which promotes the entire progress of artificial intelligence technology. In contemporary society, the three main characteristics of artificial intelligence technology are respectively, imitation, extensibility and expansibility. In addition, the main characteristics of artificial intelligence
technology can be combined organically with ideas of experts and professors, which can make it possible that the artificial intelligence technology can be in operation with the thinking process of experts and professors. In contemporary society, the artificial intelligence technology can be made the most of in almost every fields, such as aeronautic field, agricultural field, educational field and so on [1]. The main characteristics of artificial intelligence technology is shown in figure 1.

![Figure 1. The main characteristics of artificial intelligence technology](image)

2.2. Wind Power Generation

The main features of wind power generation is shown in figure 2. The wind power generation, to tell the truth, is transforming the wind energy to the electric energy, in essence, the wind power generation is a kind of common energy, which is clean and pollution-free. In addition, the wind power generation, needless to say, is a sort of renewable energy. Furthermore, in the past, our ancestors utilized the wind energy throughout the way of the windmill, as a matter of fact, in order to draw water and mill flour [2].

![Figure 2. The main features of wind power generation](image)

2.3. Automatic Control System

The automatic control system, to be frank, includes PLC system design, the design and installment of control system, the design and installment of frequency conversion system, the design and installment of electrical heating, mechanical and electrical technology service, needless to say, it is the new product of the information and intelligence technology, which meets the enterprises’ managers’ mentality, moreover, those preceding requirements put the advancement of the automatic control system on fast exceedingly track as well [3]. All in all, the whole operation process of the automatic control system can be split into two aspects, respectively, are system control and system supervision, and the former is to control the operating operation of the automatic control system, and the latter is to supervise the operating operation, to be specific, the latter can give a feedback to staff and help staff modify and update the operating process of the automatic control system.

2.4. The Wind Power Generation Technology

Under the research, development and utilization of new energy, the wind power generation technology, to be frank, is rising in contemporary, can be a sort of new energy technology, to be specific, play a vital role in new energy generation technology. In addition, the wind power generation technology, as every one
can see it, is based on the wind energy, and focuses on the wind energy. Furthermore, the wind power generation technology, in contemporary society, can be an ingenious renewable energy, and it boosts broad and promising application range. In recent years, the application scope of the wind power generation technology can be extended and broadened in every aspects in all walks of life. In spite of the wind application scope of the wind power generation, there are a good supply of intractable problems relevant to the limitation of electricity storage [4]. At the same time, with the popularization of the wind power generation technology, in terms of the characteristics of the wind power generation technology, it mainly are made the most of in land or coastal waters because of its affluent resources, and strong exploring potential. In addition to the characteristic of non-pollution, it are made the most of in overwhelming majority of areas.

3. The Application Advantages of the Automatic Control System of the Wind Power Generation

With putting the advancement of the automatic control system and the wind power generation on fast distinctly track, overwhelming majority of experts and scientists figure that an ingenious approach that integrating organically the wind power generation with the automatic control system, which is benefit to the the advancement of the automatic control system as well as the optimizing of the wind power generation, such as respectively, the improvement of accurateness of decision, the providence of individualized service and the promotion of new types of business.

3.1. The Improvement of Accurateness of Decision

The artificial technology can play a vital role in the management decision of the automatic control system of wind power generation, for decision makers, and furthermore, with the rapid extension and explosive growth of the data of the automatic control system of the wind power generation, such as respectively, image data, the operation data of generator sets, and so on, and a good supply of data are elected and analyzed by experts and professors throughout a variety of intelligence technology, to provide various services and assistance with different situations [5].

3.2. The Providence of Individualized Service

The artificial intelligence technology can choose valuable data from a variety of data and can make a detailed analysis in valuable data to gain crucial information, which makes it possible for experts and professors to make great progress on the automatic control system of the wind power generation, in other words, makes it likely for experts and scientists to research and figure out targeted service schemes [6].

3.3. The Promotion of New Types of Business

In the past, the automatic control system of the wind power generation cannot be based on artificial intelligence technology, thereby triggering the wind power generation only provide common services for users, on the contrary, artificial intelligence technology can be made the most of by experts and professors, throughout Internet platforms, users can make a variety of functions in operation, such as respectively, Internet management and cross-district administration.

4. The Application System of the Automatic Control System of Wind Power Generation Based on Artificial Intelligence Technology

With putting the advancement of science and technology on fast vastly track, experts and professors figure out that the there is an organic integration of the automatic control system of wind power generation and artificial intelligence technology, which not only can be benefit to the productivity and effectiveness of the automatic control system of wind power generation as well as the wide application scope of artificial intelligence technology. In addition, the paper comes up with an ingenious construction method of the automatic control system of wind power generation based on artificial intelligence technology, and in detail outlines the application method of the different intelligence technology of the artificial intelligence technology [7].
4.1. Expert System Technology

The expert system technology is a vital role in artificial technology, which is an intelligence inference system, to be specific, it can process and analyze data and information, extract valuable knowledge throughout effective approaches, in addition, the expert system technology can be researched and developed from symbol inference system, thereby having outstanding ability in reasoning and analysis, furthermore, the expert system can be designed to judge and ratiocinate various modes of the automatic control system of wind power generation, and judge and ratiocinate the reasons of system failure as well. In addition, it can be combined with fuzzy control technology, to make an accurate, correct and rapid judgment on the reasons of system failure of the automatic control system of wind power generation based on artificial intelligence technology.

4.2. Differential Geometry Technology

In the differential geometry technology, the non-linearity system is the most crucial component, which can be made most of by experts and professors into torque control and converting technique, and overwhelming majority of experts and professors have already figured out non-linearity multiple input decoupling control method and non-linearity multiple output decoupling control method, to control the two subsystems of the automatic control system of the wind power generation, that is to say, double feed electric generator linkage and rotate speed system. When the value of wind speed higher than the rated value, the rotational speed of electric generator will be decreased [8]. In essence, based on the changes of differential geometry feedback linearity, to accomplish the linearization of non-linearity models of all generating set equipment, to tell you the truth, needless to say, in order to control constant power of the alternating current tacho generators. In addition, it has the complicated algorithm of the differential geometry technology, and raises a higher claim for computers, therefore, it has limitation to a certain extent, to be frank, of practical application of the differential geometry technology.

4.3. Adaptive Control Technology

The change state of technological parameter should be paid attention to by experts and professors, when making the most of adaptive control technology, which can modify the control parameter all the time, throughout the changes of parameters in the perception process, and establish an scientific and feasibly system model, needless to say, in order to control the system. Due to the relatively complicated system model, experts and professors have to build relatively high productivity and effectiveness of the electric pitch adaptive control system, to tell the truth, in order to ensure the effect of tracing. In contemporary society, with the advancement of science and technology, overwhelming majority of people come to realize the DFIM speed-sensorless vector control technology, which can play a crucial role in the application of the automatic control system of the wind power generation, which can realize the synchronization double feed power generation equipment and control and supervise the speed-sensorless. Under the support of adaptive control technology, the speed curves can be traced scientifically and accurately, and the dynamic wind speed can be accurately and scientifically controlled and analyzed, needless to say, in order to ensure the productiveness of the wind power generation. At the same time, the adaptive control technology can be forecast in advance by operators, under the acquirement of maximum wind power, it can decrease gradually the equipment abrasion, to the minimum, throughout the self-correcting regulators based on adaptive control technology, so as to predict in advance the operation process of the automatic control system of the wind power generation and conduct the compensation control [9].

4.4. Optimal Control Technology

Because of a good supply of interference factors, the automatic control system of wind power generation will be made a good supply of adverse impact on, therefore, it can make the most of the optimizing system of the optimal control technology, build corresponding mathematical models to control the automatic system, which is different from the method of local linearization, and can accurately make a decoupling on the linearization and make the most of linearity optimal control, to be frank, to capture the maximum wind power. In addition, due to the large change of rotor current, when the wind power equipment is in operation, thereby there is a large contradiction between the wind power equipment and the
low-fluctuation requirement of electric power. In order to cope with this conflict, to be frank, in order to cope with this intractable problem of generatrix voltage interference because of the transform of high power load, and at the same time, experts and professors are supposed to ensure the speed ratio of the optimal apex, as every one can see it, capture the maximum wind power of rated wind speed.

4.5. Artificial Neural Network Technology

The artificial neural network technology, to be frank, can be also called nonlinear mapping, and at the same time, it can has high relatively adaptive ability and relatively high self-organizing capability, in addition to the adaptive ability and self-organizing capability, it boasts high robustness as well as high fault tolerance [10]. In essence, the artificial neural network technology can predict in advance the wind speed in a short period of time, as a matter of fact, throughout the time series. In addition, choosing scientifically neural network input variables, in the application of multilayer back propagation (BP) and generalized regression neural network, to be simple, in order to predict accurately in advance the sequence of wind speed. Moreover, the artificial neural network technology can decrease the power volatility, and predict in advance the generating capacity of the wind power generation. Despite there are a good supply of uncertain factors, the automatic control system of the wind power generation can be in operation effectively and scientifically. At the same time, making an organic integration of the artificial neural network technology and fuzzy logic technology, as the matter of fact, in order to control and supervise the load frequency, and then acquire higher control ability [11]. The application system of the automatic control system of wind power generation based on artificial intelligence technology is shown in figure 3.

![Figure 3](image)

**Figure 3.** The application system of the automatic control system of wind power generation based on artificial intelligence technology

5. Conclusion

With putting the artificial intelligence technology on exceedingly fast track, the wind power generation can be combined organically with artificial intelligence technology, as the matter of fact, the paper figures out an ingenious construction of the automatic control system of wind power generation based on artificial intelligence technology, and in the author’s judgment, relevant departments, to be frank, need to optimize the automatic control system of the wind power generation all the time, in order to meet those requirements of society and enterprises, at the same time, making the most of artificial intelligence technology can accurately and scientifically control the automatic control system of wind power generation, needless to say, so as to make an improvement in the effectiveness of power generation. Above all, the automatic control system of the wind power generation based artificial intelligence technology can be designed to improve the durable years of facilities and effectiveness and productivity of the wind power generation.

6. Reference
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