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Optimization Design of Independent Photovoltaic Power System

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Abstract: Solar energy as a huge amount of renewable energy, the daily arrival of the earth's surface radiation energy equivalent to hundreds of millions of barrels of oil burning energy. Development and use of rich, vast solar energy, cannot produce or produce little pollution to the environment, solar energy is both the urgent need for future energy supplement, but also the basis of future energy structure. However, because the traditional do not pay much attention to the collocation of PV modules, resulting in a lot of waste, this paper presents a new optimization design method for the shortcomings of the previous system design methods. This paper summarizes the composition and operation of the PV system, and discusses the establishment of the mathematical model of each part. Including the solar radiation resource model, the best tilt model of the solar cell matrix, the solar cell square power generation model, the battery status model, the load model. On the basis of this, the paper takes the minimum energy loss of PV system as the principle, and studies the problem of maximum power point tracking and the selection of inverter circuit, which has certain practical application value

Keywords: photovoltaic power generation MPPT buck chopper circuit optimization design solar cell square

1. Introduction

1.1 Global and china solar resources and evaluation

The sun is the eternal energy of the earth, which emits about 3.8 * 1020 megawatts of energy per second in space in the form of optical radiation, of which 2.2 billion is projected onto the earth. The solar radiation outside the earth's atmosphere is between 132.8-141.8 megawatts/cm 2, and about 70% of the earth is reflected, scattered and absorbed by the atmosphere. Earth received a year of solar radiation can be as high as 1.8 * 1018 kwh, tens of thousands of times the global energy consumption.

Huge solar energy is the source of all things on earth, in addition to its eternal and huge, but also has a broad, decentralized, random, intermittent, cleanliness and so on. In the oil, natural gas and nuclear mineral deposits will eventually be depleted today, full use of solar energy is clearly a double great significance of continuous energy supply and environmental protection. After the '9.11' incident in the united states, the giant grid was challenged, and the distributed energy system using solar energy was taken seriously. 'Everywhere sunshine everywhere,' the beautiful ideals will eventually be accompanied by the pursuit of green energy for people to achieve.

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China's vast territory, has a wealth of solar energy resources. It is estimated that the solar radiation energy received by our country's land surface is about 50 * 1018 kJ per year, and the total solar radiation in all parts of the country is 335 - 837 kJ / (cm2), the median is 586 kJ / (cm 2 years). From the distribution of the total solar radiation in the whole country, tibet, qinghai, xinjiang, southern inner mongolia, shanxi, northern shanxi, hebei, shandong, liaoning, western Jilin, central and south western yunnan, southeastern guangdong, southeastern fujian the eastern part of the island and the western part of taiwan and the southwest of the vast area of the total solar radiation is very large. Especially in the qinghai-tibet plateau region, where the average altitude above 4000 meters, the atmosphere is thin and clean, transparent, low latitude, long sunshine time. For example, the city of lhasa, known as the 'nikko city', the average of 1961-1970, the average annual sunshine time is 3005.7h, the relative sunshine is 68%, the annual sunny day is 108.5 days, cloudy day is 98.8 days, year the average cloud cover is 4.8, the total solar radiation is 816 kJ/(cm 2 years), higher than the other provinces and regions of the same latitude. The total solar radiation in sichuan and guizhou provinces is the smallest, especially in the sichuan basin, where the rain is more, the fog is more and the sunny day is less. For example, known as 'fog' is called chengdu, the average annual sunshine hours are only 1152.2h, relative to the sunshine is 26%, the average annual sunny day is 24.7 days, cloudy day 244.6 days, the average annual cloud cover up to 8.4. Other areas of the total solar radiation in the center.

China's main features of solar energy distribution are:

1. The high-value centers and low-value centers of solar energy are in the area of 220 - 350 latitude, the qinghai-tibet plateau is a high-value center, and the sichuan basin is a low-value center.

2. The total solar radiation, the western region is higher than the eastern region, and in addition to tibet and xinjiang two autonomous regions, is basically lower in the south than the north.

3. Because most of the southern areas of cloud fog, in the latitude 300 - 400 area, the distribution of solar energy and the general solar energy with the latitude and the opposite of the law, the solar energy is not reduced with the increase in latitude, but with the increase in latitude and increase.

One, two, three areas, the annual sunshine hours greater than 2200 hours, the total solar radiation is higher than 502 kJ/cm 2, is china's solar energy resources rich or rich areas, a larger area, accounting for the total area of more than 2/3, with good use of solar energy conditions. Four or five areas, although solar energy conditions are poor, but there is still a certain value.

According to the distribution and characteristics of china's solar energy resources, china's solar energy resources can be evaluated as follows: In addition to chongqing and its surrounding provinces (i.e. Sichuan and guizhou), all regions of china are high solar energy resources, especially inner mongolia, the qinghai-tibet plateau and other places solar energy resources is rich. So china is a solar energy-rich country, has a certain advantage.

Area classification annual sunshine hours' total solar radiation [KJ / (cm2 · a)] equivalent to burning standard coal (kg) including areas with foreign regions.

A northern part of northern Ningxia, northern Gansu, southeastern Xinjiang, western Qinghai, western Tibet, northern India and northern part of northern Pakistan.

Two 3000-3200 586-670 200-225 northwest Hebei, northern Shaanxi, southern Inner Mongolia, southern Ningxia, central Gansu, eastern Qinghai, southeastern Tibet, southern Xinjiang, Jakarta area.

South, southeastern Henan, southeastern part, southern part of northern Xinjiang, northern Xinjiang, Jilin, Liaoning, Yunnan, northern Shaanxi, southeastern Gansu, southern Guangdong, southern Fujian, northern Jiangsu, northern Anhui, Tianjin, Beijing, southwestern Taiwan, United States.

Four, northwest of the province, southern part of southern Jiangsu, south of Anhui, Heilongjiang, northeastern part of Taiwan, Milan, Italy.

Beijing, Guizhou, Chongqing, most parts of Europe

Research and development of photovoltaic power generation

In the photovoltaic power generation system, there are

many factors that affect the efficiency of power generation, including the conversion efficiency of solar cells and the control of the maximum power point. At present, the following algorithms are developed in the tracking of maximum power points.

(1) Constant voltage control

The PV array is a non-linear power supply. Its output characteristics can be seen as the constant current region and the constant voltage region, the two areas of the junction point is the maximum power point. Thus, at different light intensities, the PV array will have such a maximum power output point, from the power point of view can be regarded as the current operating conditions under the optimal point. As the light intensity and temperature changes will change these constant current and constant voltage region, so the maximum power point is also changing.

Generally, the open-circuit voltage of a silicon-type photovoltaic array is affected by the junction temperature. At the same light intensity, the maximum power point is also affected by the temperature. When the power output of the PV array changes with temperature, if the constant voltage tracking control strategy is still used, the output power of the array will deviate from the maximum power output Point, resulting in a relatively large power loss. In particular, in some cases, the junction temperature of the PV array is relatively obvious, resulting in the array of volt-ampere curves and the system pre-set the operating voltage may not exist in the intersection, then the system will produce oscillation.

(2) Improved constant voltage algorithm

In order to overcome the use of the occasion season, sooner or later and weather conditions and environmental temperature changes on the impact of the system, based on the constant voltage algorithm can take the following several ways to deal with compromise:

Manual adjustment: by manually adjusting the potentiometer according to the season given different, this method uses less, need manual maintenance.

1. According to the thermometer adjustment: in advance the specific photovoltaic array at different temperatures measured at the maximum power point voltage stored in the controller, the actual operation, the controller according to the detection of photovoltaic array temperature, through the look-up table to select the appropriate value.

2. Reference battery method: in the photovoltaic power generation system to add a PV array with the same characteristics of the smaller photovoltaic cell module to detect the open circuit voltage, according to the fixed coefficient calculated by the current maximum power point voltage, this method can be in the approximate constant voltage of the control costs are close to the MPPT control effect.

(3) Interference observation method

Interference observation method is one of the commonly used methods to realize MPPT. The principle is to increase or decrease the voltage at regular intervals and observe the direction of the subsequent power change to determine the next step of the control signal. This control algorithm also generally uses power feedback, that is, the use of two sensors on the DC bus current and the voltage across the sampling. This control method, although the algorithm is simple, and easy to implement hardware, but the response is very slow, only applies to those light intensity changes are very slow occasions. In the steady state case, this algorithm will cause the actual operating point of the PV array to oscillate slightly near the maximum power point, which will cause some power loss. When the light changes rapidly, the tracking algorithm may fail and judge the wrong Tracking direction.

(4) Conducting incremental method

The conductance increment method changes the control signal by comparing the conductance increment and the instantaneous conductance of the PV array. This control algorithm also requires sampling the voltage and current of the photovoltaic array. Conductivity incremental method is accurate, fast response time, suitable for rapid changes in atmospheric conditions of the occasion. But the requirements of the hardware, especially the precise requirements of the sensor are relatively high, all parts of the system response speed requirements are faster, so the entire system hardware cost will be relatively high.

(5) Fuzzy logic control

Due to the uncertainty of solar light intensity, the change of PV array temperature, the change of load situ-

ation and the nonlinear characteristics of PV array output characteristics, there are many factors to be taken into account to realize the accurate tracking of the maximum power point of PV array. A fuzzy logic control algorithm is developed for this nonlinear system. The fuzzy logic method is used to control the MPPT of the PV system, which has good dynamic characteristics and precision, and has a very wide application prospect.

With the development of technology, in addition to the above control algorithms, we have developed a variety of algorithms including hysteresis comparison method, neural network control method, optimal gradient method, etc. These algorithms implement the basic principles of MPPT control Is similar, but the specific implementation methods are different.

2. Composition and working principle of independent photovoltaic power generation system

2.1 Composition of an independent photovoltaic power generation system

Solar photovoltaic power generation system, according to their use of different places, can be divided into two categories of space applications and ground applications. On the ground can be used as a separate power supply, but also with wind turbines or diesel engines and other components of the hybrid power generation system, but also with the power grid to send power to the grid. At present the application of a wide range of solar photovoltaic power generation system is mainly used as a ground independent power supply. The usual independent solar photovoltaic power generation system is mainly composed of solar cells, batteries, controllers and blocking diodes, the role of which are as follows:

1. Photovoltaic battery square: the role of the square is the direct conversion of solar radiation into electrical energy, the supply of load. Generally, by a number of solar modules in a certain way to connect, coupled with the appropriate bracket and junction box.

Battery: battery is a solar cell array energy storage device; its role is to send a sunny square in the excess energy stored in the evening or rainy days for the use of load. In the solar photovoltaic power generation system, the battery in the floating charge and discharge state, the amount of summer sunshine, in addition to the supply of electricity, but also on the battery charge; in the winter sunshine less, this part of the stored energy gradually released, in this seasonal the basis of the cycle but also with a much smaller day cycle, the daytime square to the battery charge, (while the square also to the load of electricity), the night the load power all by the battery supply. Therefore, the requirements of the battery self-discharge are small, and the charging efficiency is high, but also consider the price and ease of use and other factors. Commonly used batteries are lead-acid batteries and silicone batteries, requiring higher occasions are also more expensive nickel-cadmium batteries.

3. Controller: In different types of solar photovoltaic power generation system controller is different, its function and how much complexity vary widely, according to the requirements of the power generation system and the importance of to determine. The controller is mainly composed of electronic components, instruments, relays, switches and other components. In a simple solar cell, battery system, the role of the controller is to protect the battery, to avoid overcharge, over discharge. If the PV power plant and power supply, the controller will need to automatically monitor, control, regulation, conversion and other functions. If the load is AC, the load and the battery should also be equipped with an inverter, the role of the inverter is the square and the battery to provide low-voltage direct current into 220 volts AC power supply, the use of load.

Blocking diodes: also known as anti-charging diodes or isolation diodes, the role of the diode is to use one - way conductivity to prevent no sunshine when the battery through the solar cell discharge. The requirement for blocking diodes is that the operating current must be greater than the maximum output current of the square, and the reverse withstand voltage is higher than the voltage of the battery pack. In the matrix work, blocking the two ends of the diode has a certain voltage drop on the silicon diode is usually 0.6v - 0.8v; scotty or germanium tube 0.3v or so.

2.2 The working principle of an independent photovoltaic power generation system

Solar PV power converter is a solar cell, also known as photovoltaic cells. The principle of solar cell power gen-

eration is the photovoltaic effect. When the sun shines on the solar cell, the battery absorbs light and produces electron-hole pairs. In the battery built-in electric field, the electrons and holes are separated, the battery at both ends of the accumulation of different charges, that is, 'light production voltage', which is 'photovoltaic effect.' If the two sides of the built-in electric field leads to the electrode and connected to the load, the load will have 'light current' flow, in order to obtain power output. In this way, solar energy has become a practical energy can be put into.

(1) Solar cells absorb a certain amount of energy photons, the semiconductor generated within the electron - hole pairs, known as the 'photogenerated carriers', the opposite of the two, the opposite of the two, (2) electrons and holes are collected by the positive and negative electrodes of the solar cells, respectively. (2) The electrons and holes are separated by the positive and negative electrodes of the solar cells, and in the external circuit to generate current, so as to obtain electrical energy.

The solar power generation system (also known as solar photovoltaic power generation system) is a solar power generation system that converts solar radiant energy into electricity by solar cells. ground solar photovoltaic power generation system operation mode, can be divided into two major categories of off-grid operation and network operation. The solar photovoltaic power generation system, which is not connected with the public grid, is called off-grid solar photovoltaic power generation system, also known as independent photovoltaic power generation system, mainly used in away from the public power grid without electricity and some special places. The solar photovoltaic power generation system connected with the public power grid is called the networked solar photovoltaic power generation system, which is the stage of solar photovoltaic power generation into large-scale commercial power generation, becoming one of the important parts of the power industry. It is the development of solar photovoltaic power generation technology in today's world the mainstream trend. In particular, the combination of photovoltaic cells and building roof solar photovoltaic power generation system, is the development of many developed countries, hot, rapid development, broad market, attractive prospects.

3. Mathematical models of modules for independent photovoltaic power generation systems

3.1 The best inclination model of solar cell square

Selection principle

It can be seen from the foregoing description that the total solar radiation obtained at the inclination angle is directly related to the square angle β.

Solar cell array is usually placed for the equator; the relative plane has a certain inclination. The differences in the amount of solar radiation received by the various sides of the square are very different. For the whole year of the fixed load of fixed photovoltaic matrix, if the design of the incline of the radiation is small, which means that more solar cells need to ensure that the user power supply; if the slope of the solar radiation fluctuations in the month, means that the need A large number of batteries to ensure that the solar radiation is low in the month of electricity supply. Which will improve the cost of the entire system, so to determine the best angle of the square is an indispensable photovoltaic power generation system design an important part.

The choice of square angle should be combined with the following requirements:

(1) Continuity. The total amount of solar radiation in a year is generally continuous change, most of the monotonous movements, there are a small number of ups and downs.

(2) Uniformity. The choice of the best inclination to meet the surface of the square on the surface of the average daily radiation received more uniform, so as not to receive radiation in summer is too large, resulting in waste; and the amount of radiation received in winter is too small, resulting in battery over discharge, reduce system life, affecting system power supply stability.

(3) The greatness. When choosing the inclination, it is necessary not only to obtain the maximum amount of radiation in the weakest month on the surface of the square, but also to minimize the average daily radiation.

(4) Particularity. The specific situation to do a specific analysis, and sometimes for the longest rainy days for the longest time to obtain the most of the solar radiation;

summer power consumption, square angle should be the value of the square array summer radiation relative to the winter more appropriate; sometimes consider the winter snow load, deliberately increase β; also take into account the overall architectural synergy to determine the square of the β value.

Optimal inclination model

The angle of inclination is the angle between the square of the solar cell and the horizontal ground, and it is hoped that this angle is the best inclination angle when the power generation is the largest in one year.

The best inclination angle in a year is related to the local geographical latitude, and when the latitude is high, the corresponding inclination angle is also large. However, as with the azimuth, the design of the roof should also take into account the tilt angle and snow slipping angle (slope greater than 50% - 60%) and other restrictions.

There is an increase in the total power generation amount even when the amount of electricity generated during the snowy period is increased, and therefore, it is not necessary to give priority to the snow fall in the system of grid-connected power generation, but also to further consider other factors. For the south (azimuth angle of 0°), the tilt angle from the horizontal (tilt angle of 0°) began to gradually transition to the best tilt angle, the daily increase in the amount of sun until the maximum, and then increase the tilt angle the amount of radio is decreasing. In particular, after the inclination angle is greater than 50° to 60°, the amount of solar radiation decreases abruptly until the final vertical placement, the amount of electricity is reduced to a minimum. The square array from the vertical placement to 10°- 20° tilt placement has practical examples.

In the case where the azimuth angle is not 0°, the value of the slope of the sun is generally low, and the value of the maximum solar radiation is near the inclination angle close to the horizontal plane.

Above the relationship between the azimuth angle, the inclination angle and the amount of electricity generated, the azimuth angle and the inclination angle of a particular square are designed to be further combined with the actual situation.

3.2 Impact of shadows on power generation

Under normal circumstances, we calculate the amount of electricity generated in the square is completely without the shadow of the premise obtained. Therefore, if the solar cells cannot be directly illuminated by sunlight, then only scattered light used to generate electricity, this time the power generation than the shadow to reduce the about 10% to 20%. In response to this situation, we have to correct the theoretical calculation.

Usually, there are buildings and mountains and other objects around the square, the sun came out, the building and the mountains around the shadow, so in the choice of laying the square place should try to avoid the shadow. If it cannot escape, but also from the solar cell wiring method to solve, so that the shadow of the impact of power generation to a minimum.

In addition, if the square is placed before and after the back of the square and the front of the distance between the square after the front of the square of the shadow will be behind the square power generation impact. There is a bamboo pole with a height of L1, the length of the shadow in the north-south direction is L2, the sun height (elevation angle) is A, and the azimuth angle is B, assuming the shadow rate is R, then: R = L2 / L1 = ctgA × cosB this type should be calculated on the day of the winter solstice, because that day the longest shadow. For example, the height of the upper edge of the square is h1 and the height of the lower edge is h2, then the distance a = (h1-h2) when the latitude is high, the distance between the square increases, and the area of the place is increased accordingly. For the anti-snow measures of the square, the tilt angle is large, so the height of the square increases, in order to avoid the impact of the shadow, the corresponding will also increase the distance between the square. Usually arranged in the array, should be selected each square of the structural size, its height adjusted to the appropriate value, so that the use of its height difference between the square to adjust the distance between the minimum. Specific solar cell array design, in a reasonable determination of the azimuth and tilt angle at the same time, should also be a comprehensive consideration in order to make the square to achieve the best condition

3.3 Solar cell square power generation model

As mentioned above, a solar cell is a device capable of converting light energy into electrical energy by means of a photovoltaic effect, also known as a photovoltaic device. Design a PV array for a photovoltaic power generation system, as with other engineering design processes, to understand the design requirements and conditions, and then a comprehensive analysis, to determine the program, selection development, test commissioning

Design principles and ideas

In the design process to pay attention to two issues, one is to quantify the uncertainty, the other is to optimize the design. There may be many uncertainties involved in the environment, materials and processes throughout the design process. In order to reduce the uncertain factors, to avoid the risks and design bias they bring, in the design as much as possible to quantify these uncertainties, the so-called optimization design is based on user requirements, material changes, test data and The emergence of new technologies, constantly changing the design, and strive to make certain specific indicators (such as the most efficient, lowest cost or lightest weight) to achieve the best, or in a number of contradictory design objectives to achieve a balance between. But the optimal design of photovoltaic arrays must be coordinated with the overall system design, and ultimately subject to the entire system.

Generation model

In general, the photovoltaic array output characteristics have a non-linear characteristic, and its output by the light intensity, ambient temperature and load conditions. In a certain light intensity and ambient temperature, the photovoltaic cells can work at different output voltage, but only in a certain output voltage, the photovoltaic cell output power to reach the maximum, then the photovoltaic cell operating point reached output power voltage curve of the highest point, called the maximum power point. Therefore, in the photovoltaic power generation system, to improve the overall efficiency of the system, an important way is to adjust the operating point of the photovoltaic cell in real time, so that it always works in the vicinity of the maximum power point, when the solar cell power generation power is the largest, also played the greatest efficiency.

3.4 Load model

The local user's electricity load model is a necessary condition for designing a photovoltaic power plant. The expected daily load variation curve and the monthly load variation curve should be set as accurately as possible. As shown in Figure 3-1, several typical daily electricity load models are shown.

(C) changes in daily electricity load.

The area covered by the min curve is the power consumption QL of the load for that period(3-15)

In a similar way to draw the monthly and annual electricity load curve, and the time taken for a month or year, it is easy to obtain the monthly load power consumption or annual load power consumption.

3.5 Battery status model

In this paper, the use of lead-acid batteries, in the ground independent photovoltaic power generation system, the battery is second only to the most important components of photovoltaic components, so the rational allocation of battery capacity is very important. By the knowledge of the battery, we can see that if the battery is overcharged for a long time, this overcharge will cause excessive loss or vaporization of water. But also can cause the positive plate active material loosening and peeling, thus reducing the battery capacity and the expected life; the contrary, if the battery is in the over-discharge or loss of long-term state, the plate grows large grain lead sulfate will replace the normal circumstances of the small grain, resulting in vulcanization state, curing will make the battery recharging extremely difficult. The design idea of this paper is based on the load of electricity consumption to determine the capacity of the ba ttery.

In the formula, B said battery capacity, d said the maximum number of days of power supply, generally take 5-7 days, QL said load day power consumption, K said battery power capacity correction factor, SOCmin said battery deep discharge limit.

4. Solar battery MPPT controller

In the photovoltaic power generation system, to improve the overall efficiency of the system, an important way is to adjust the operating point of the photovoltaic cell in real time, so that it always works in the vicinity of

the maximum power point, this process is called the maximum power point tracking. As shown in Figure 4-1, the main parameters of the photoelectric voltammetry curve of the solar cell array are open circuit voltage, short circuit current, optimum working voltage, optimum working current and optimum input power. To find the best work point for this need an algorithm,

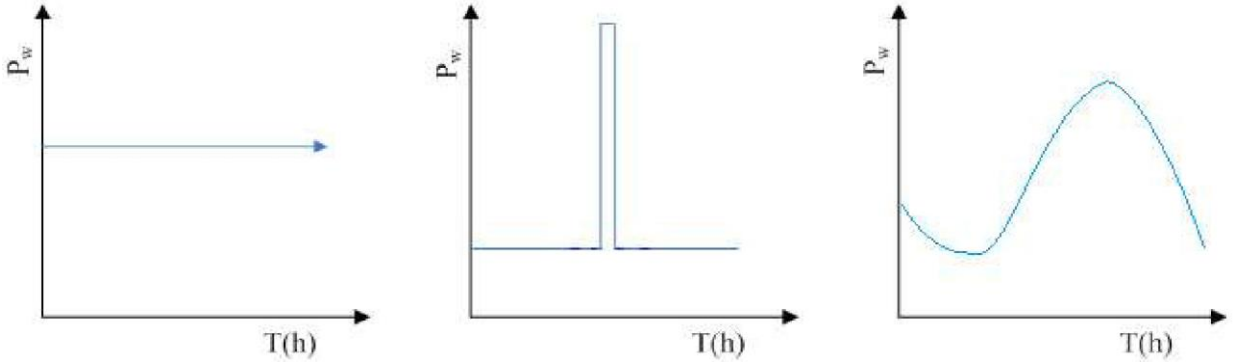

Figure 3-1 (a) 24h the electricity load is constant; (b) in the daily constant load 1h load suddenly increased;

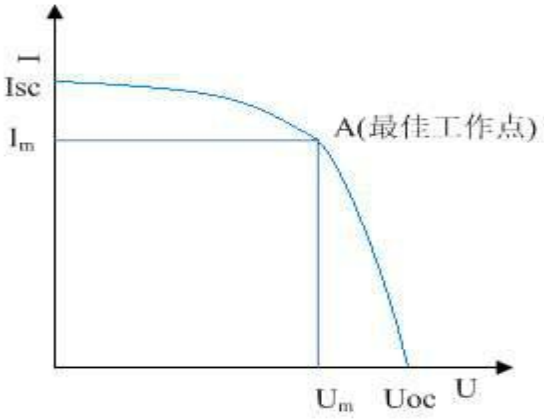

Figure 4-1 Photovoltaic voltammetry behavior of the solar cell array

4.1 Selection of maximum power point tracking algorithm

Photovoltaic battery maximum power point tracking algorithm is typical of: constant voltage tracking method, disturbance observation method, conductance increment method, on the improvement there is: variable step-length admittance method, based on fuzzy control MPPT method, MPPT method based on predictive data, MPPT method based on solution of difference equation. Here mainly explain the disturbance observation method

Perturbation observation method is to change the operating voltage of solar cells at regular intervals, real-time observation to change the output power before and after the two points to change the direction of the regulation voltage, and ultimately stabilized near the maximum power point. Although the disturbance observation method will cause the actual operating point of the solar cell to oscillate slightly near the maximum power point, resulting in a certain loss of micro power, but the method only needs to measure the current and voltage parameters, so easy to implement and widely used.

Since the solar cells output different powers depending on the load, they cannot be directly connected to the load. In order for the solar cell to provide maximum power to the load, an impedance converter (typically a DC/DC converter) must be added between the solar cell and the load, and the converter can be controlled by appropriate control algorithms so that the transformed work Point just

corresponds to the maximum power point of the solar cell. The usual practice is to use the microprocessor and the corresponding interface, the drive circuit for DC / DC converter digital control to achieve. In contrast to this, based on the disturbance observation method, by comparing the rate of change of the output current of the solar cell and the rate of change of the output power, the simple control circuit is used to control the Buck converter so that it can track the maximum of the solar cells in real time power point. Compared with the digital control, it has the advantages of good real-time tracking and low price. And then through simulation to verify the correctness and feasibility of the proposed method.

To make the actual operating point of the system fall, from the point of view of circuit matching, which requires an impedance converter. When the environmental conditions change, the solar cell output characteristics change, the impedance converter can be adjusted accordingly the equivalent load impedance, so that under different output characteristics can work at the maximum power point.

The impedance converter can be implemented with a DC/DC converter (such as a Buck converter), as shown in Figure 4-2 (a). In order to facilitate circuit analysis and intuitive understanding, Figure 4-2 solar cells with an adjustable DC voltage source plus slip line rheostat combination to simulate the replacement, as shown in the figure shown in the solid box. For the load resistor, Buck converter and can be equivalent to resistance, as shown in Figure 4-2 (b). Adjust the DC power supply voltage and current, the equivalent of changing the external environment on the impact of solar cells.

4.2 Control of maximum power point tracking

The main circuit of the system studied in this paper uses the buck converter to implement MPPT, which is used to charge the 48V lead-acid battery on the load side, as shown in Figure 4-3. For ease of analysis, the output voltage-current characteristics and power-current characteristics of the solar cell are simply shown as shown in Figure 4-4.

In Figure 4-4, Uoc and Isc are the open circuit voltage and short circuit current of the solar cell respectively. Um and PM are the voltage and current of the maximum power point (MPP) of the solar cell, respectively, corresponding to the maximum power of the output. That is, its output current corresponding to the maximum power point (MPP), then the maximum slope, the maximum output power of solar cells. In order to realize the maximum power point tracking (MPPT) of the system of Figure 4-3, it is necessary to connect an energy storage capacitor in parallel with the traditional buck circuit in the solar photovoltaic power generation system. When the switch is off, to ensure that the solar cell output current is continuous, will not cause its work intermittent, always in the best working condition, so as to avoid the loss of power. Through the control of the buck converter switch off to control the storage capacitor charge and discharge, so that the maximum output voltage of solar cells, that is, the final maximum power.

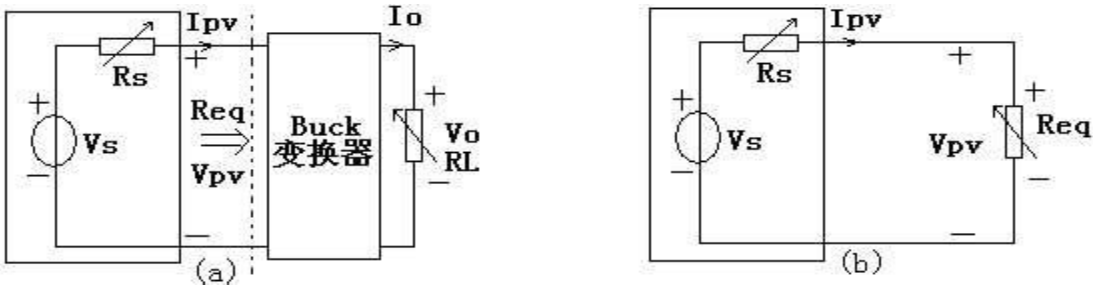

Figure 4-2 Equivalent circuit of photovoltaic power generation system with MPPT

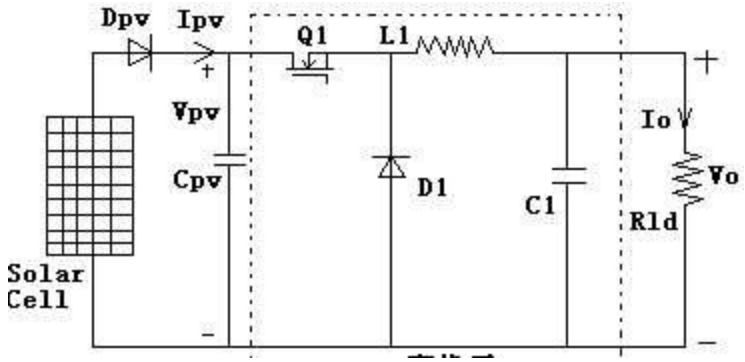

Figure 4-3 Maximum power point tracking system main circuit

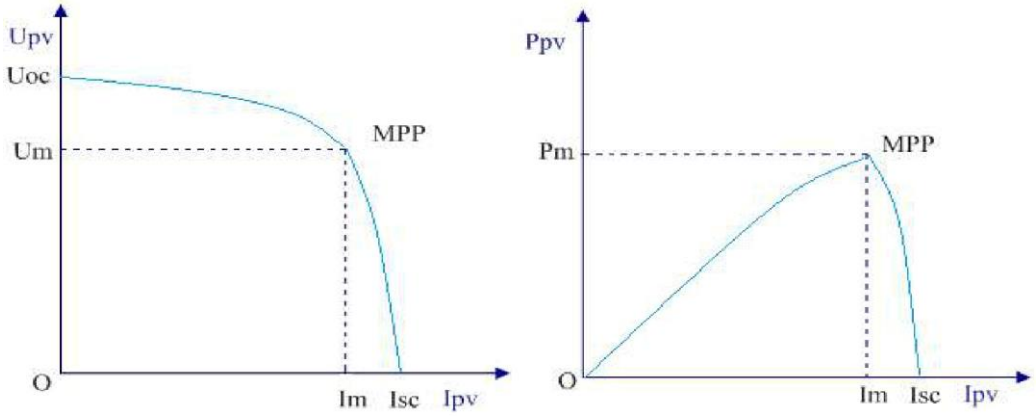

Figure 4-4 Output characteristics of solar cells

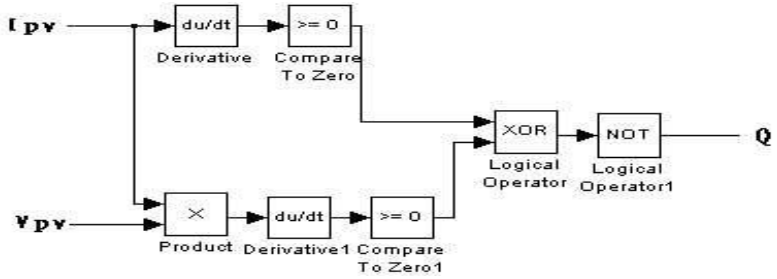

Figure 4-5 Maximum power point tracking analog controller

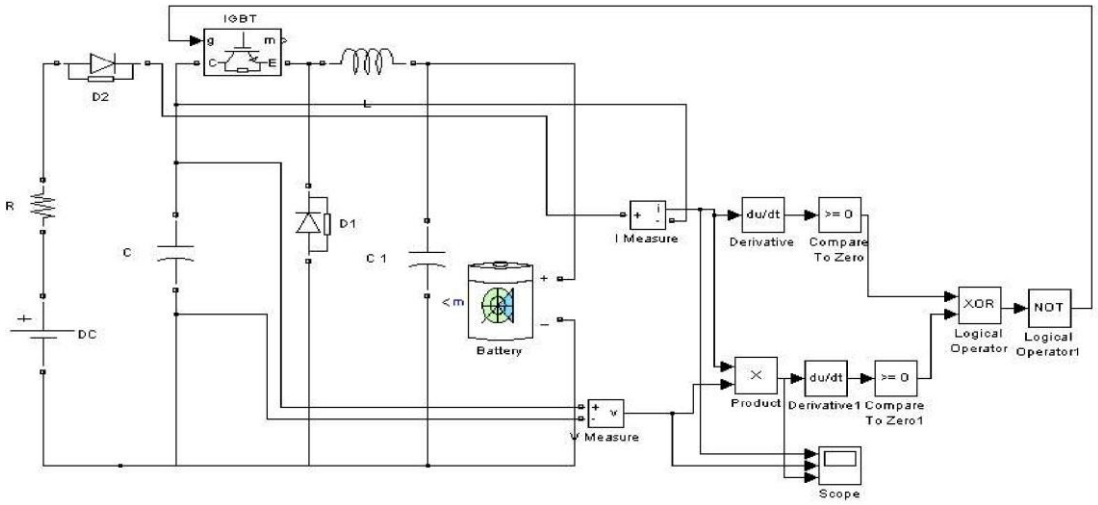

Figure 4-6 Mat lab simulation verification diagram

5. Conclusions

It is one of the important members of the new energy and renewable energy family by means of solar cells talking about solar energy, which is an unlimited source of clean solar radiation and converted into electricity. In recent years, the world's solar cell production and installed capacity to annual growth rate of about 30% of the rapid development of the end of 2004 the world's total installed capacity has reached 4330MW or so. By the middle and late 21st century, solar photovoltaic power generation will develop into an important power generation mode, in the world's sustainable development of energy structure occupies a certain proportion.

Which uses the maximum power point tracking system based on perturbation observation method, so that the PV array always work in the best working point, the use of mat lab simulation, the effect is very good, the use of the maximum power point tracking to improve the efficiency of the system, reduced unnecessary losses. After the above steps can make the system investment to reduce a little, so that the system more reasonable.

In the aspect of inverter, the system compares the advantages and disadvantages of various inverter circuits, and finally adopts the three-phase full-bridge inverter and the PWM control method based on no-difference beat. Finally, the mat lab simulation is used to achieve the original purpose. Good to complete the task of this subject.

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