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2021 Volume 8 Issue 2
ISSN: 2251-2608

Electronics Science Technology and Application

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Volume 8 Issue 2 • 2021

ISSN: 2424-8460

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Electronics Science Technology and Application

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Research on Human-computer Social Interaction Design in the Era of Artificial Intelligence

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Abstract: With the improvement of China's scientific and technological level, the relevant technologies are constantly updated, and the era of artificial intelligence is gradually coming. In such background, with the rapid development of human-computer interaction technology, there appear a great number of intelligent equipment and devices, which can realize human-machine interaction and even emotional communication and social communication. Such technologies can not only make people's life more smart and convenient, but also change the way of human life and social situation, which place great importance on China's social development. Therefore, this paper focuses on the design of the human-computer social interaction in the era of artificial intelligence. Firstly, it introduces the relevant overviews of artificial intelligence and human-computer interaction; Then it makes a case study on the design of the human-computer social interaction based on intelligent equipment; At last, it proposes some suggestions for the development for the human-computer interaction technology so as to provide support for related work.

Key Words: tificial intelligence; human-computer interaction; social interaction; design research

1.Introduction

In recent years, we witnessed China's rapid development in science and technology as well as in network technology, and we are also encountering the developing upsurge in technologies like artificial intelligence and virtual reality technology put forward a few years ago. And the interaction design and human-computer interaction or related disciplines have also attracted much attention in the society, and the organic combination of the two will provide better environment for the further development and research of relevant technologies and will achieve a good results. However, there appear some problems in the corresponding technologies during the research. Although interaction design is developed from human-computer interaction, interaction design has been separated from human interaction after numerous researches and practices and has become an independent field. The purpose of interaction design is to make full use of the personnel and things by using artificial intelligence. Nowadays, with the rapid development of Internet, researches on artificial intelligence has gradually turned to study on interaction patterns and behavior, and insert emotional and social communication as well as logical cognitive model in interactive behavior to make forward feedback and backward feedback, so that it can realize the human social interaction and emotional interaction and improve people's experience in human-computer interaction^[1]. Artificial intelligence is not only the background of the era, but also the premise to realize the sociality and intelligence of machines. At present, many researches have fully considered the sociality in interpersonal communication and the superficial expression in interpersonal interaction, but failed to deeply analyze the human-machine relationship. Machines are usually used as a medium for communication. With the improvement of machine intelligence, the emotional interaction between humans and machines is gradually shown, fully highlighting the emotional and social nature of intelligent machines, and providing new topics for subsequent research.

2.Relevant overview

2.1 Overview of the Human-machine interaction

There is a close relationship between the development and progress of interactive technologies, among which artificial intelligence is one of the most crucial interactive technologies. To make full use of artificial intelligence will play a great role in improving the design level and dimension development of interactive technology. First of all, there is an antagonism between the generation of artificial intelligence and the initiation of interactive behavior. This is because in the initial formation period of interactive behavior, relevant scholars only explored human-machine interface based on artificial intelligence. Secondly, the enlightenment period of artificial intelligence echoes the initial development stage of interactive behavior. Since the concept of human-computer interaction was put forward in 1976, relevant disciplines have gradually studied human-computer interaction and exerted influences on various artificial skills, network communication and other technologies, thus interaction design came into being.

The artificial intelligence technology gradually developed from non-intelligence to intelligence. During its development, we can adopt viable artificial intelligence technology and super artificial intelligence technology to realize the intellect logic by making the native emotion subjects abandon their primary physiology, and implement the transformation of human thoughts from Newton thought to the quantum thinking, etc., which is gradually evolved into the diagnosis of a certain behavior based on the prediction of a target. The ultimate goal of the development of artificial intelligence is to use artificial intelligence technology to realize automatic decision-making. Variety of information architecture and the experience mode made their efforts to promote the evolution of transformation from metadata to knowledge and wisdom to information, in which the transformation from wisdom to inspiring users' experience should be a kind of services based on a certain algorithm. Such transformation can realize the combination between the individual small data and cloud big data and finally realize a constant interaction behavior and system and expand the corresponding physical information space into the digital space.

3. Application cases of human-computer social interaction

3.1 Volkswagen Beetle

In human-machine tools design, the most important things are usability and viability as well as the fluency of interaction. After the emotional design model meets the basic requirements, it is necessary to consider the impact of design on human sociality and emotion. Cars are the most typical mechanical tools and transportation tools, taking Volkswagen Beetle as an example. Launched from 1938 to 2003, the Volkswagen Beetle was the best-selling design in automotive history. It had a unique emotional design, with a round headlight to represent the anthropomorphic eyes, a spoon-shaped thinking headstock, and a downward curve to represent a smile. The headstock is designed based on the aerodynamic conception, and conveys optimism, hope and interesting attitudes towards human. Human culture has changed dramatically over the past few decades, but people can still obtain a common emotional connection from the Beetle, which is why the Beetle has been a huge success in design.

Analyzing the human-machine design from the perspective of emotional design, the Beetle design with the “smiling face” creates a simple interaction of “smiling - feedback”, which is successful in stimulating the positive emotions of human. Such design can also make the car form a role with special personality emotion and achieve the goal of human social interaction^[2].

3.2 Bots

Bots, also known as chatbots and intelligent robots, are intelligent dialogue systems designed based on natural language processing systems to help and simulate human dialogue activities. They are used in mobile terminals like mobile phones and the PC terminals. We can use virtual robot to realize the sending and receiving of the messages in the

conversational interface and make the robots complete the conversation. There are two kinds of virtual robots, namely, non-conversational robots and conversational robots.

Virtual intelligent robots can understand and answer questions posed by people, such as Apple's collection of Siri, Google's Assistant, and Microsoft's voice assistants like Cortana and Bing, which are all chatbots. In the common chat software WeChat and QQ, there are also many chatbots. In the beginning, intelligent robots also had certain creative abilities, such as Microsoft's Bing, which was able to write poems by memory through using a specific algorithm and it had published its collection of poems "Sunshine Lost its Glass" in 2017.

Virtual robots were greatly development in 2016. Major Internet giants have increased research efforts on them and started mass production, from Facebook's Messenger to Google's APLAI, from Microsoft's Bot Framework to Apple's third-party voice access like Siri, etc. At present, the further development and research on related technologies have greatly improved the intelligence level of virtual robots, and they can also be competent for some human work and communication. The appearance of virtual robot represents the breakthrough and innovation of various softwares in the era of artificial intelligence. Virtual robots provided editing services for human life by creating a life landscape, which further improved people's life quality. The Bots system using man-machine dialogue can realize multiple rounds of dialogue, which has a better effect in social interaction than other search engines.

3.3 Intelligence speaker

The intelligence speakers, as one of the examples of human-machine social interaction and a product of "social interaction + consumer-oriented TOB service", is widely used by its characteristics of high cost performance, prominent advantages in function and intelligence as well as humor and small size. Among them, the most representative and most widely used is Baidu's Xiaodu, Huawei's Xiaoyi, Xiaomi's Xiaoai and Tmall wizard and so on. Xiaodu is more suitable for family use, which supports Bluetooth call and equipped with functions like Bluetooth networking, universal remote control, voice control, voice message, etc. Such equipment is instrumental to a certain extent. It can execute the instructions given by human beings, and can update the networking and push information after networking. It mainly interacts with human beings through indicator lights and voice communication, etc. and achieves its social functions.

4. Suggestions for human-machine interaction design

To deeply anthropomorphize on machines and equipment, anthropomorphizing refers to endow the unique characteristics of human beings with non-human entities to form the tendencies and morphologies of human[3]. As for the current development, although some scholars regard anthropomorphizing as a negative cognitive bias and immature technical behavior, a large number of studies and experiments prove that anthropomorphizing has a good impact in most cases. For example, anthropomorphizing nature can enhance people's awareness of environmental protection, and anthropomorphizing animals can promote people's awareness of animal protection. Xiao Ai, the most widely used intelligent housekeeper in the market, when endowing people's characteristics with other creatures or products, can have a positive effect on its users.

For sellers, it can increase sale amounts and sale results for the sellers to endow human characteristics with products. Artificial intelligence products on the market can be better integrated into users' lives by anthropomorphizing them, and meanwhile, users can also get better experience. The anthropomorphizing behavior to the intelligent housekeeper system can also help the housekeeper to adjust its contents to adapt human life and help the product to further position itself, which is another way to explore the human-computer interaction in the field of psychology. At present, researches from psychologists have proved that the application of anthropomorphizing in artificial intelligence system is also an important tool to study human psychological activities by inferring human psychology through their behavior.

To anthropomorphize the artificial intelligence product is also an important part of emotional design in interaction design. By buying an intelligent product, the users will not only experience the function of the artificial intelligence but

also social and emotional communication, which will help users improve their life quality by using virtual housekeeper and also help the product created emotional communication. According to current big data and researches on the user's psychology, it is helpful for the users to better understand machine language through anthropomorphizing the artificial intelligence machines and making it more intelligent in social communication ability and emotional output ability. What we need to do is to create a kind of human-machine interaction similar to human-human interaction so as to meet the emotional needs of the users when using the products.

5. Conclusion

In general, when researching on human-computer interaction technology under the background of artificial intelligence, it is necessary to explore the possibilities of the human-machine interaction in future development from the perspective of mutual influence. In the future research and development of human-computer interaction technology, cooperation and design with other disciplines to make technology transform into better productivity will create more value for people's lives. By reflecting on the development of intelligent machine technology, we will push human wisdom to the peak relying on the development tide of artificial intelligence and broaden people's vision and bring new experience to human life.

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Digital Pre-distortion Technology For Optimization Design Of VDB Transmitter

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Abstract:Due to the nonlinear distortion of the power amplifier, the problems of in-band distortion and Adjacent Channel Interference will occur in VDB transmitter .To address the problem ,this paper introduces a digital pre-distortion method based on memoryless polynomial model ,which can solve the coefficients of digital pre-distorter with indirect learning structure. The results show that the digital pre-distortion method can effectively improve the third-order intermodulation distortion, the adjacent channel power ratio (ACPR) and the error vector amplitude (EVM) of VDB transmitter, and it can also improve the performance and efficiency of the communication system.

Key words:VDB transmitter ;memoryless polynomial ;digital pre-distortion

1. Introduction

Ground Based Augmentation System(GBAS) is used to provide precise approach and landing guidance to the airspace of aircraft . The VHF Data Broadcast radio is an important part of the GBAS system. It modulates the differential enhancement information generated by the ground satellite navigation reference receiver and transmits the data with power amplifier.

The performance of the power amplifier is an important factor affecting the efficiency and communication quality of VDB transmitter. When the power amplifier is in the area of the nonlinear, it will lead to the distortion and out-of-band spectrum expansion of VDB transmitter, resulting the interference of the adjacent channel^[1]. In order to overcome the nonlinear distortion of VDB transmitter, the linear optimization is carried out with digital pre-distortion.

2. Pre-distortion Structure

2.1 Basic Principles Of Digital Pre-distortion

Digital pre-distortion technology does non-linear processing , so that the amplitude and phase characteristics of the baseband signal are distorted in the opposite direction ,and the overall linear relationship between the input and output signals is realized^[2]. The basic principle of digital pre-distortion is shown in Figure 1 below:

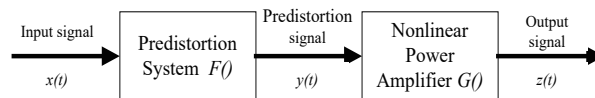


Fig.1The principle diagram of pre-distortion system

The principle of digital pre-distortion processing can be expressed as follows:

$$z(t) = G(F(x(t))) = L(x(t)) = Amp * x(t) \quad (1)$$

The symbol Amp is the linear magnification of the signal.

The objective of digital pre-distortion technology is to find the digital pre-distortion transmission function $G(x)$, so that the input signal can satisfy the linear amplification transmission after the combination of digital pre-distortion and nonlinear power amplifier^[3].

2.2 Memoryless Polynomial Model

The common methods of digital pre-distortion include lookup table (LUT) method and polynomial model method. Polynomial model method has a faster convergence speed and self-adaptability, which is widely used in digital pre-distortion design.

The polynomial model method includes memoryless power amplifier model and memory power amplifier model. The signal of VDB transmitter belongs to narrow band signal and the memory effect is no obvious, so we select the memoryless power amplifier model.

The memoryless power amplifier model means that the output signal is only related to the current input signal and has nothing to do with the historical input^[4]. Generally, AM/AM and PM/PM distortion curves can be used to describe the characteristic of the amplitude and phase in memoryless power amplifier models. The model can be expressed as follows:

$$\begin{aligned} z(n) &= \sum_{k=1}^K a_k x(n)^k \quad (2) \\ &= a_1 x(n) + a_2 x(n)^2 + \dots + a_K x(n)^K \end{aligned}$$

where $x(n)$ and $z(n)$ represent the input and output signals of the power amplifier at the n moment, a_k is the factor of each power, K is the highest order of the polynomial^[5].

The modulation distortion caused by even order in memoryless polynomial model will fall outside the frequency band and be filtered by band-pass filter. In this paper, we mainly focus on the odd order intermodulation distortion which is difficult to filter out in the intermodulation distortion component. Therefore, the power amplifier model only considers the odd terms, and the polynomial model can be changed into:

$$\begin{aligned} z(n) &= \sum_{k=1}^K a_k x(n)^{2k-1} \\ &= a_1 x(n) + a_2 x(n)^3 + \dots + a_K x(n)^{2K-1} \quad (3) \end{aligned}$$

In practice, it is necessary to involve the high power of polynomial calculation. In order to simplify the calculation, the polynomial model is used as follows:

$$z(n) = \sum_{k=1}^K a_k x(n) |x(n)|^{k-1} \quad (4)$$

2.3 Indirect Learning Structures

Generally, there are two kinds of ways to obtain the parameters of digital pre-distortion model: direct learning structure and indirect learning structure. The direct learning structure needs to predict the parameters model of the power amplifier, while the indirect learning structure only needs a set of the input signals, output signals and the ideal linear magnification of the power amplifier^[6]. This paper adopts the indirect learning structure to estimate the parameters.

The implementation block diagram of the digital pre-distortion with indirect learning structure is shown in figure 2, where $x(n)$ is the input signal, $y(n)$ is the digital pre-distortion signal, $z(n)$ is the signal of the power amplifier, G is the ideal linear magnification of the power amplifier, $v(n)$ is the estimated coefficient of the digital pre-distortion, and $e(n)$ is the error between the actual value of the digital pre-distortion and the estimated value. The estimated parameter values

is modified adaptively according to $e(n)$ [7]. When the error $e(n)$ is zero, the linear amplification of the power amplifier is realized.

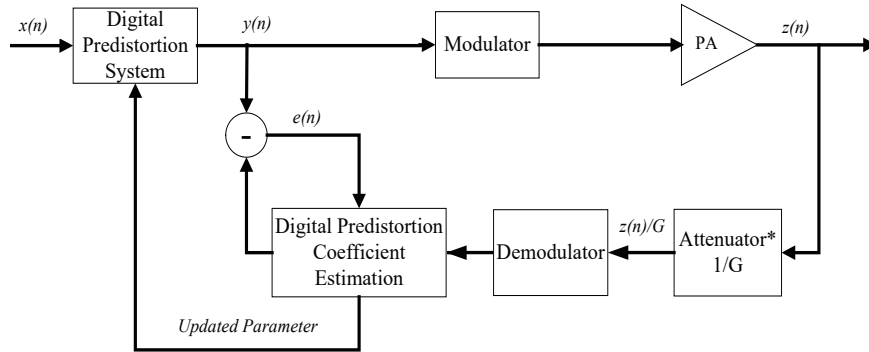


Fig.2 The indirect learning structure of digital pre-distortion

The objective of the pre-distorter is to obtain the estimated coefficient of the digital pre-distortion. According to equation (4), We can first define:

$$z(n) = \sum_{k=1}^K a_k \phi_k(x(n)) \quad (5)$$

Then equation (4) can be changed to:

$$\phi_k(x) = |x|^{k-1} x \quad (6)$$

Define $N \times 1$ order vector of the input signal:

$$x = [x(1), x(2), \dots, x(N)]^T \quad (7)$$

$N \times 1$ order vector of the output signal:

$$z = [z(1), z(2), \dots, z(N)]^T \quad (8)$$

$K \times 1$ order vector of the parameter:

$$a = [a_1, a_2, \dots, a_K]^T \quad (9)$$

Re-defined

$$\phi_k(x) = [\phi_k(x(1)), \dots, \phi_k(x(N))]^T \quad (10)$$

$$\Phi = [\phi_1(x), \phi_2(x), \dots, \phi_K(x)] \quad (11)$$

The equation (6) can be expressed as:

$$z = \Phi \cdot a \quad (12)$$

According to the least square method^[8](LMS)

The parameter vector can be obtained as follows:

$$\hat{a} = (\Phi^H \Phi)^{-1} \Phi^H z \quad (13)$$

The calculation involves the transpose and inverse of matrix, which is complicated and suitable for calculation in the DSP processor.

3 System Simulation and Verification

Matlab is used to verify the linear optimization effect of digital pre-distortion. The main parameters of the VDB signal^[9] are shown in table 1:

3.1 Power Amplifier Model

Table 1 The main parameters of the VDB signal

Parameter	Value
Frequency/(MHz)	108-117.975
Power/(W)	≤ 80
Modulation	D8PSK
Bandwidth/(KHz)	25
Code Rate/(KHz)	10.5
Filter	Raised Cosine Firer
Roll-Off factor	0.6

Saleh model^[10] is a typical narrow-band power amplifier model, which can well characterize the AM/AM and PM/PM characteristics of power amplifier. Its expressions are as follows:

$$G_{\theta}(r) = \frac{a_{\theta} r}{1 + \beta_{\theta} r^2} \quad (14)$$

$$G_R(r) = \frac{a_R}{1 + \beta_R r^2} \quad (15)$$

The parameters selected in this paper are as follows :

$$\beta_0 = 2.135, \beta_R = 1.13, a_0 = \beta_R = 1$$

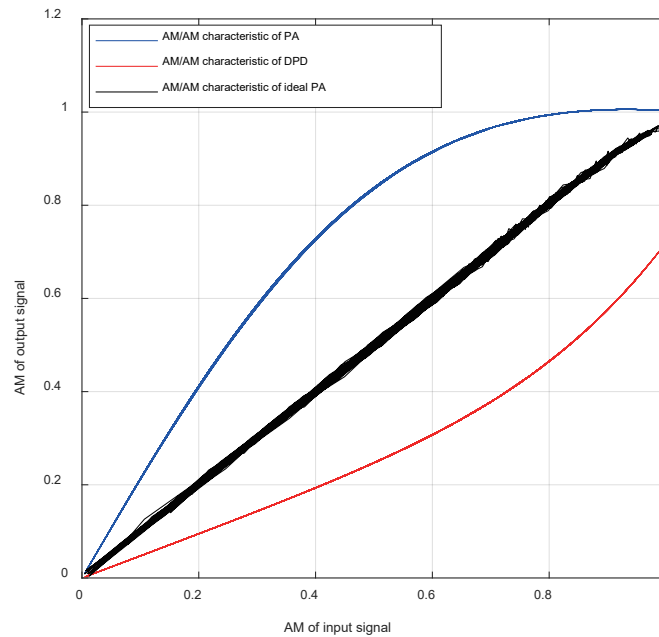


Fig.3 AM /AM Characteristic curve

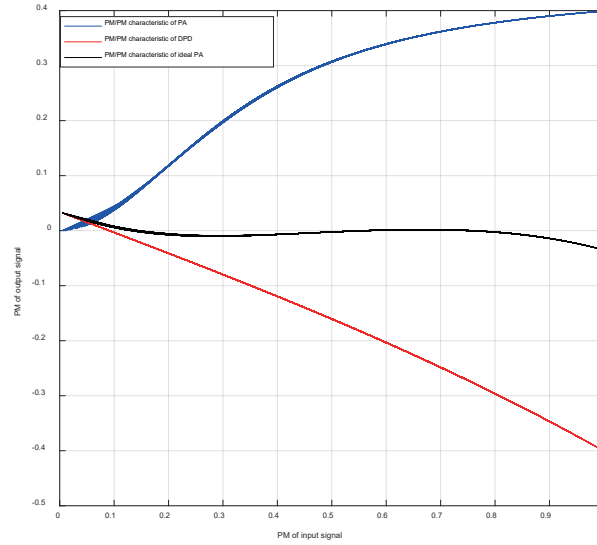


Fig.4 PM/PM Characteristic curve

Figures 3 and 4 respectively show the AM /AM and PM/PM characteristic curves of the VDB signal after power amplifier and the digital pre-distortion. It can be seen that the output curve after the combination of digital pre-distortion and power amplifier is nearly linear, which effectively improves the performance of the power amplifier.

3.2 Critical Performance Analysis

The effect of pre-distortion was evaluated by comparing the Adjacent Channel Power Ratio(ACPR) before and after digital pre-distortion. The simulation results are shown below:

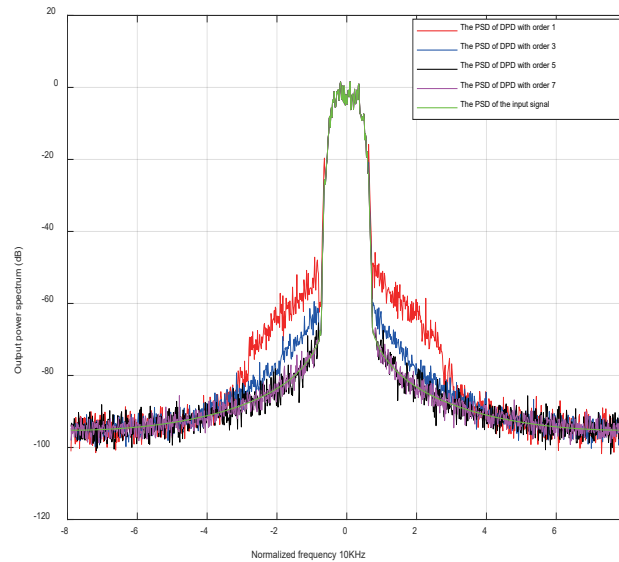


Fig.5 The comparison of the PSD with different order polynomials

Figure 5 shows that when the order is from $K=1$ to 3, the ACPR increases about 16 dB. When the order is from $K=3$ to 5, the ACPR increases about 10 dB, and when the order is from $K=5$ to 7, the ACPR increases about 3 dB. If the order K is above 7, the power spectral density after pre-distortion is almost as the same as the input signal. It can be seen from the diagram that the order 3 and 5 are the major components of nonlinear distortion and the composition

above order 7 is obviously reduced. Therefore, in order to reduce the amount of calculation, the order of $K=5$ is adopted in engineering applications.

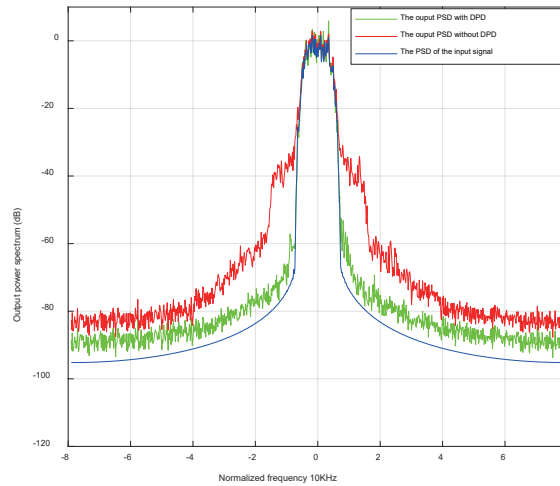


Fig.6 The comparison of PSD

Fig. 6 shows the comparison diagram of the power spectral density of original baseband signal, the power spectral density without and with digital pre-distortion (order $K=5$). As can be seen from the figure, the ACPR of the signal without digital pre-distortion is -35dB , while the ACPR of the signal with digital pre-distortion is -50dB , and the improvement degree reaches 15dB . It can be seen from the simulation results that the spectrum expansion is effectively suppressed with digital pre-distortion correction, the power spectrum density is very close to the original signal, and the final signal of the power amplifier has a good linearity.

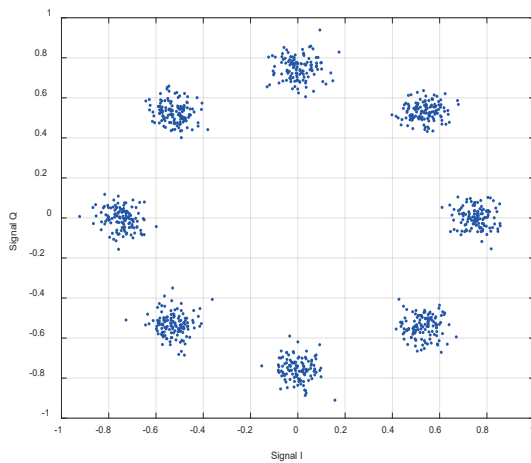


Fig.7 The constellation from the power amplifier without digital predistorter

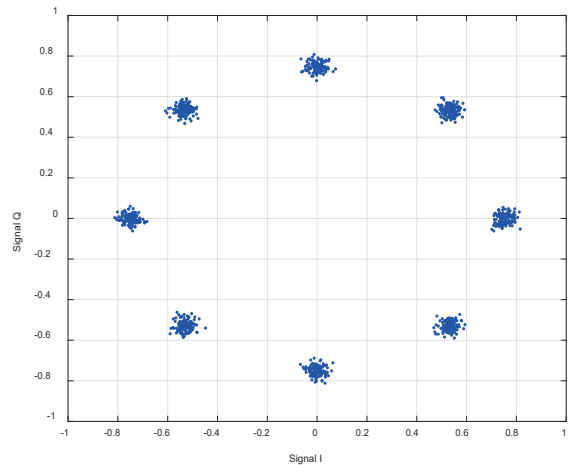


Fig.8 The constellation from the power amplifier with digital pre-distorter

Figure 7 shows the constellation of the VDB signal without digital pre-distortion, and figure 8 shows the constellation with digital pre-distortion. From figure 7, it can be seen that the distortion and divergence of the constellation caused by the nonlinearity of the power amplifier, and EVM is 5.6% , while the constellation with digital pre-distortion processing is more condensed and EVM increases to 2.8% . At the same time ,the amplitude and phase of the VDB signal are corrected.

The simulation results show that the digital pre-distortion method with memoryless polynomial model can effectively improve the linearity of power amplifier ,ACPR and EVM can also be significantly improved.

4 Terminology

In this paper, by using the digital pre-distortion method with memoryless polynomial model, the nonlinear distortion of power amplifier are solved effectively ,and the efficiency of VDB transmitter are improved. At present, the scheme has been applied in the project, meeting all the indicators and achieving good results.

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Intelligent Voice Augmented Reality Interactive

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Abstract: Voice enables people to transmit information better and more quickly, and people can control all kinds of machines to communicate and work by intelligent voice. This paper intends to use intelligent voice to achieve new cloud classroom teaching. The effect that the teacher can move the picture in real time through voice control and reply accordingly can be achieved by speech synthesis, speech recognition and voice interaction technology. The efficiency of the classroom is improved while the interest of the classroom has been enhanced.

Keywords: Intelligent voice; Cloud classroom; Voice recognition ; Voice interaction;

1. Introduction

With the development of information technology, intelligent voice products are gradually integrated into all aspects of people's life, such as intelligent speakers, intelligent watches, intelligent learning machines and so on. Intelligent voice technology has become the most convenient and effective means for people to obtain and communicate information. At present, intelligent speech technology mainly includes four key links. VPS signal processing, ASR pattern recognition, NLP natural language processing and TTS speech synthesis.^[1] Based on this, this paper puts forward the concrete scheme of applying intelligent speech in cloud classroom teaching.

2. Status of the study

Language is a unique communication tool between people at the beginning. With the continuous development of science and technology, human can communicate with machines through language and convey their own instructions, and machines will do the corresponding work according to the instructions. In recent years, intelligent machines have developed rapidly, and more and more exchanges with machines are made in daily life. Voice recognition technology is an important part of intelligent machines, which enables people and machines to communicate better. Intelligent voice interaction is a new type of interaction mode based on voice input, which can receive feedback results by communicating with machines. The traditional speech interaction system mainly focuses on speech recognition and speech synthesis, which can be found from the current products. In most recognition tasks, the audio used is often sampled in strictly restricted environment, which eliminates the influence of external environment on audio. However, there are some problems such as noise interference, low dialect recognition rate and poor semantic understanding fault tolerance in real audio environment, which affect the accuracy of speech interaction system to varying degrees.^[2]

3. Design scheme of voice recognition system

Cloud classroom teaching camera based on speech recognition system needs to be combined with specific

application scenarios. Combined with the current online teaching background, the design and optimization of two different operation links of teacher-side voice control and student-side voice control are carried out, and two design schemes that can be used in voice recognition system are discussed and analyzed.

3.1 The first Scheme , student voice control system

The student-side voice control system is mainly the teacher-side camera uploads the shooting content to the web page in the form of live broadcast or video recording. The student-side can realize the function of scaling and moving through the picture panel of the voice control web page, as shown in Figure 2-1.

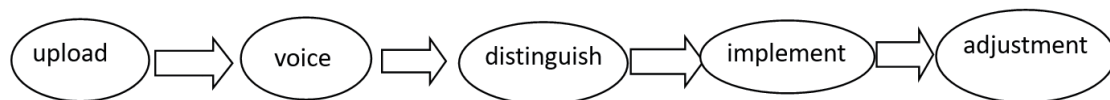


Figure 2-1 Student-side voice control system

By transmitting classroom information to the web page in real time through the cloud, students can adjust the panel content by themselves, obtain the key content information more flexible and free, and can adjust according to their own learning needs.

3.2 The second Scheme ,Teacher-side voice control system

The teacher-side voice control system mainly controls the mobile behavior of the camera by the teacher's real-time voice. Its main functions are shown in Figure 2-2.



Figure 2-2 Teacher-side voice control system

The teacher-side voice control system can be directly controlled by the teacher in real time according to the content. By sending the corresponding voice instructions, the camera can realize the functions of scaling and moving, which can further clarify the key content of the explanation, and transmit the page more intuitively to the student side. Finally, the classroom content will be sent to the cloud for teachers or students to watch again. Thus improving the quality of teaching and enhancing students' learning efficiency. The advantage is that the overall function is easy to realize. The use experience is optimized, and the teacher-side voice control system has a wide range of applications.

The second scheme is selected for design and implementation by Considering synthetically.

4.The key technology and main features

4.1 Human-computer interaction technology

The various functions of the camera are waked up and controlled by the voice module. The voice module has the highest priority.

After power on, the camera screen defaults to the center of the blackboard, and gives voice prompt. 'Hello, I am Xiao Zhi, welcome to Intelligent Cloud class.' In view of the problem of classroom discipline, instructions except for power on are "answered" by flashing lights. The instructions are as follows.

"Xiaozhi, move to the left."

"Xiaozhi, move to the right."

"Xiao Zhi, enlarge the picture ."

"Xiao Zhi, narrow down the picture ."

"Xiao Zhi, switch the picture to the blackboard ."

"Xiao Zhi, switch to PPT."

When the power of microphone is lower than 15%, voice prompt will be given. ‘The battery is low, please charge it in time.’ After class, the teacher can turn off Xiaozhi by voice command “turn off Xiaozhi camera” or key.

4.2 Voice recognition technology

Speech recognition technology is referred to as ASR technology. It is to transform voice information into text information that can be recognized by the machine. The construction of voice recognition system includes two stages. The one is Data training stage, the other is model matching recognition stage. In the data training stage, the single chip microcomputer analyzes and processes the collected voice samples, extracts the voice feature information from them, and establishes a feature model offline. In the voice recognition stage, the user’s voice data will be automatically matched and recognized, which is usually completed online.

4.3 voice synthesis technology

The essence of voice synthesis technology is to transform text information into voice information. This design uses Alibaba cloud speech synthesis platform and cb5654 development board to extract the corresponding voice parameters from the recorded sound library. In the synthesis process, we make the sequence decision of context-related HMM training by analyzing the input text, then send the generated voice into the parameter synthesizer, and finally output the synthesized voice.

4.System process

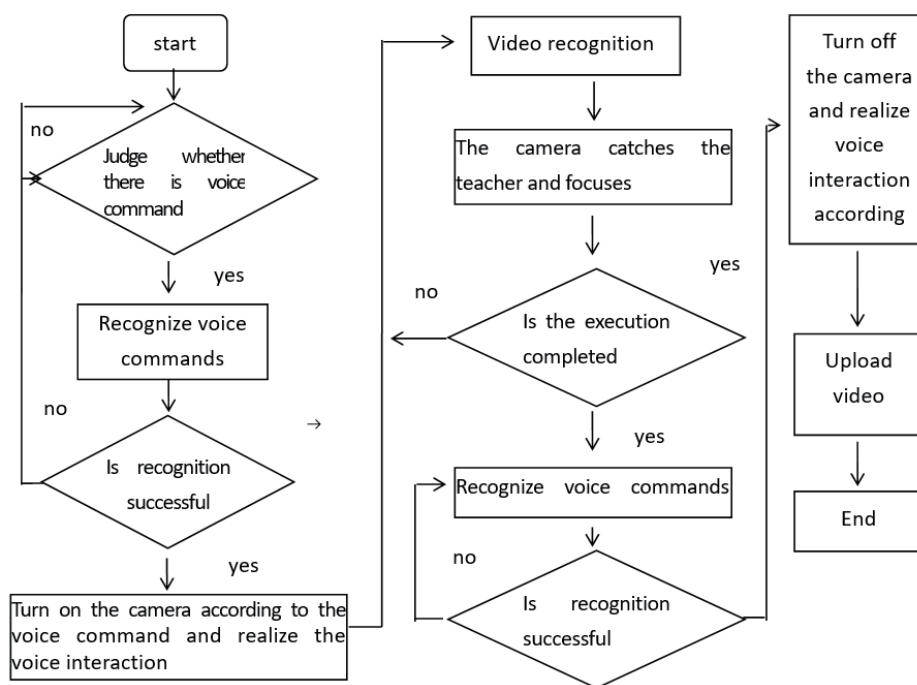


Figure 4-1 system flow chart

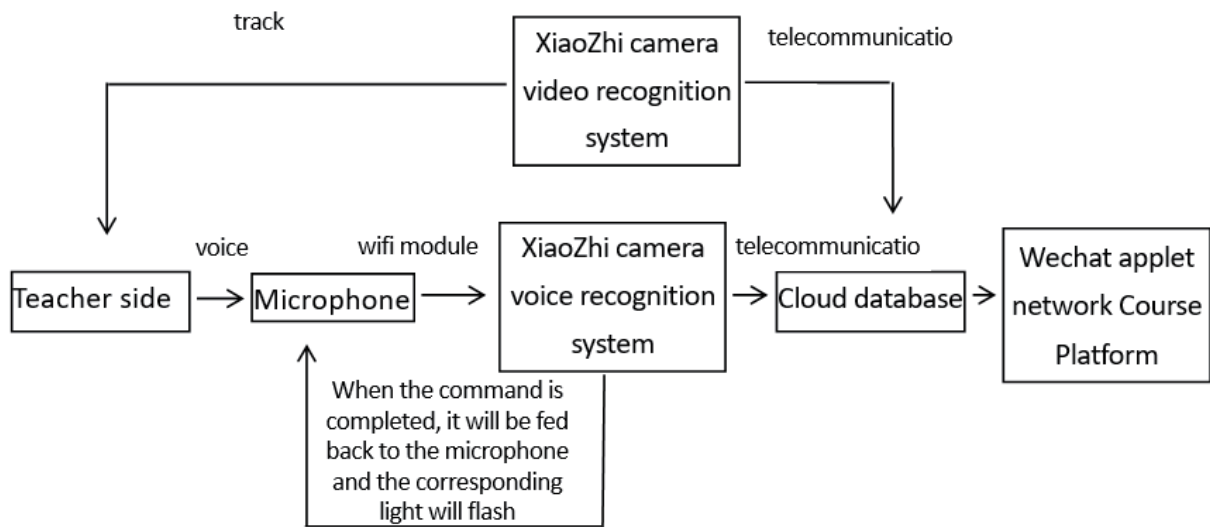


Figure 4-2 connection of each module

When the camera receives voice command (such as “Xiaozhi, move left”), it will execute the command in the way of moving. The teacher’s position is identified by target detection technology, and the blackboard’s position is identified by edge detection technology. After video recognition, it will rotate under the action of the steering gear until clearly captured the classroom picture. It will waiting for the next voice instruction to be issued after execution.

The voice instructions sent by the teacher side are received by CB5654 development board, and sent to the upper computer through the serial port to control the switch of the camera. The upper computer records the video, saves the video to the cloud database or local, and uploads it to the wechat applet.

5.voice recognition test

The teacher side sent out the voice instruction of “class begins” and CB5654 development board received and replied “class begins, please listen carefully”. The teacher side sent out the voice instruction of “class is over”, and cb5654 development board received and replied “class is over, goodbye teachers and students”.

Voice wake-up, voice capture and intelligent conversation are tested at different decibels. The environment below 30dB corresponds to classroom, the environment below 60dB corresponds to home, and the environment above 60dB corresponds to game room test. The results show that the noisier the environment is, the worse the recognition effect is. However, the probability of completing the whole intelligent conversation remains above 85%. The results are shown in the table below.

Table 1 voice test results

Decibels	Test items	Number of tests	Number of error	probability
≤30db	Voice wake up	300	0	100%
	Voice capture	300	2	99.33%
	Intelligent dialogue	300	2	99.33%
≤60db	Voice wake up	300	0	100%
	Voice capture	300	5	98.33%
	Intelligent dialogue	300	7	97.67%
60db≤	Voice wake up	300	23	92.33%
	Voice capture	300	27	91%
	Intelligent dialogue	300	36	88%

6.Conclusion

In this paper, intelligent voice technology is used to achieve new cloud classroom teaching, the teacher controls the movement of the picture changes by voice commands, which can accurately and quickly convey the classroom content to the students. Students can quickly distinguish the key content of the classroom, thus greatly improving the efficiency of learning. At the same time it can also carry out voice interaction. Active classroom atmosphere can also be invigorated by carrying out voice interaction. After that, through the information interaction of camera, database, web page or wechat applet, students can watch the classroom content again through wechat applet after class, consolidate knowledge points, and truly achieve intelligent and efficient teaching. Due to the information interaction involving different functional modules, in order to facilitate users to manage different classroom teaching information uniformly, it is necessary to establish a database in the cloud server for secure information interaction.^[3] However, The development language and environment of different functional modules are different, so it is difficult to realize the interaction between various modules, and the development cycle is long.

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Analysis of fungal system decomposition ability under Ka-Volterra model

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Abstract: Differential equations are used to describe the decomposition ability of fungi and systems with multiple species under the influence of various factors. These factors include characteristics of the fungus itself, such as mycelium elongation, water tolerance, interactions between fungal populations, and the effects of the external environment. With reference to the classical population model and the Karvolterra differential equation model, the research made a further extension on these two models to describe the change of the population size along with the time and the decomposition ability of different species of fungi by adding a series of influencing factors to the equation. The effect of the interaction between various fungi on the decomposition rate was considered. Finally, we describe the trend of the overall decomposing ability of the system under the external environment. In summary, our model starts from initial models that describe populations of different species and the wood decomposition capacity of fungi under the influence of various factors, and simulates the wood decomposition capacity of a realistic polyfungal system on a given land.

Keywords: Differencial Equations; Lotka-Volterra Model; Dynamic Behavior; Biodiver- sity; Clustering; Linear Regression

Introduction

The process of carbon exchange in the geochemical cycle is called the carbon cycle, and the decomposition of compounds is an indispensable part of it^[1]. In such a process, a vital component is the decomposition of plant material and wood fibers. According to some researches, it is found that the key species that decomposes them is fungi. Under different influencing factors and traits, the decomposing ability of fungi is also different. In addition, the external temperature and moisture and its hyphal extension rate also play important roles in the decomposition ability of specific fungi^[2]. At the same time, combined with the competition among the fungal populations, it can be found that the advantages and disadvantages of the combination of different systems are related to the actual external environment. The diversity of fungal species also promotes the decomposition ability of ground garbage to a certain extent, which has a wide range of practical applications and plays very important roles^[3].

1 Problem analysis

It is necessary to describe the rate of change in the decomposition ability of breakdown of ground litter and woody fibers, and consider the influencing factors. Combined with the method of differential equations and Lotka-Volterra model, we can list the equation of the decomposition ability of each fungus over time, and express it in the form of a matrix^[4]. Next, we consider a system model with three species of fungi that has a common relationship and is not too complicated, and combines the collected data to perform clustering and fitting operations to obtain appropriate values for some correlation coefficients, and then draw a graph of the changes of the three fungi's ability to decompose woody

fibers over time and the graph of their relationships.

Then, similarly, we can obtain the quantitative results of the effects of other external factors and own traits on the decomposition ability of specific fungi through experiments. Then, substitute the values of b_i , g_i , and w_i corresponding to the specific fungus into the aforementioned differential equation, and note that our system is under a moderate and constant temperature and moisture, combined with the value limitation in the parameters' definition, so the temperature and moisture influencing factors t and m take the value 0 in this state. At this time, we try to ignore the effect of temperature and moisture changes on the decomposition, and will specifically consider the different mutual constraints and assistance relationships between different fungi in the next question. Hence, it is reasonable to take the value of a_{ij} as 0. Under such conditions, we can make a graph of the changes in the ability of each fungus to decompose wood fibers in this system over time as shown in Figure 1.

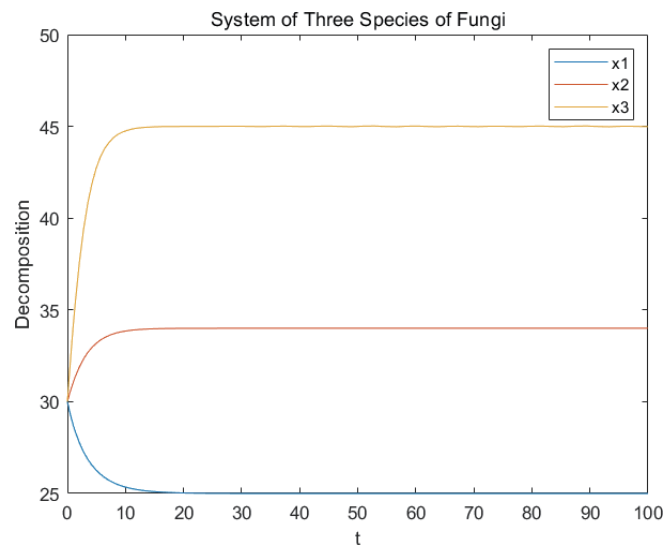


Figure 1 System of Three Species of Fungi

We can find that under this particular situation, the decomposition amount of one type of fungi will gradually decrease to zero over time, while the decomposition capacity of the other two fungi will gradually become constant after a period of rising.

2 The effects of environmental change

We first consider the specific effects of fungal interspecific relationships on decomposition capacity in the absence of environmental influences, and discuss several typical possible scenarios. Then, we add the influence of environment and discuss the results of temperature and moisture on decomposition capacity based on the aforementioned classification of interspecific relationships. Then, we analyze the sensitivity of the environment to rapid fluctuations by suddenly and rapidly changing the temperature and moisture of an otherwise more suitable environment and derive the results.

We then try to analyze the effect of environmental changes on the overall decomposition capacity of the system model of fungi. We obtained the value of the overall decomposition capacity by summing the decomposition capacity of each fungal group at the final moment.

(1) Only Temperature or Moisture Changes

If only the temperature changes, we calculate the final value of the overall decomposition capacity in the change of temperature from low to high and from negative to positive, and make a graph of its relationship with the change of temperature, as shown in Figure 2.

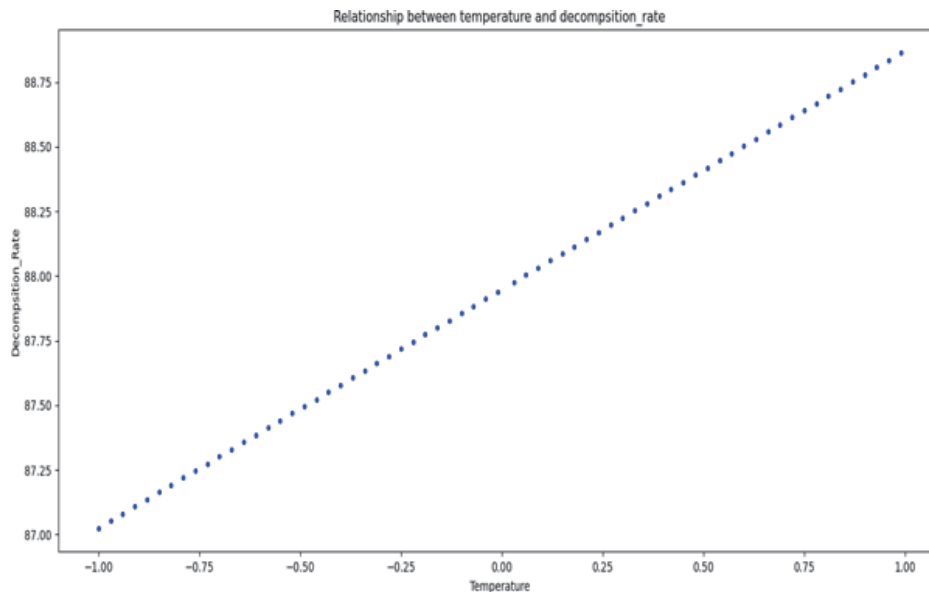


Figure 2: Only Temperature or Moisture Changes

We found that the relationship between the overall decomposition capacity and the external temperature is approximately a linear relationship when only the temperature is varied and the set temperature is increased within a reasonable range. The relationship between the overall decomposition capacity and external moisture is similar to the results for temperature, and we do not show it separately again.

(2) Both Temperature and Moisture Changes

In the following, we consider the overall decomposition capacity affected by simultaneous changes in temperature and moisture. Using the data collected, we take the data values for each of the different temperature and moisture states and draw images named Figure 3 with the value of temperature and moisture as the xy plane and the decomposition capacity of a particular fungus as the z axis. We can see that the decomposition capacity of the fungus continues to rise when the temperature and moisture move in a more positive direction and continues to fall when the temperature and moisture move in a more negative direction.

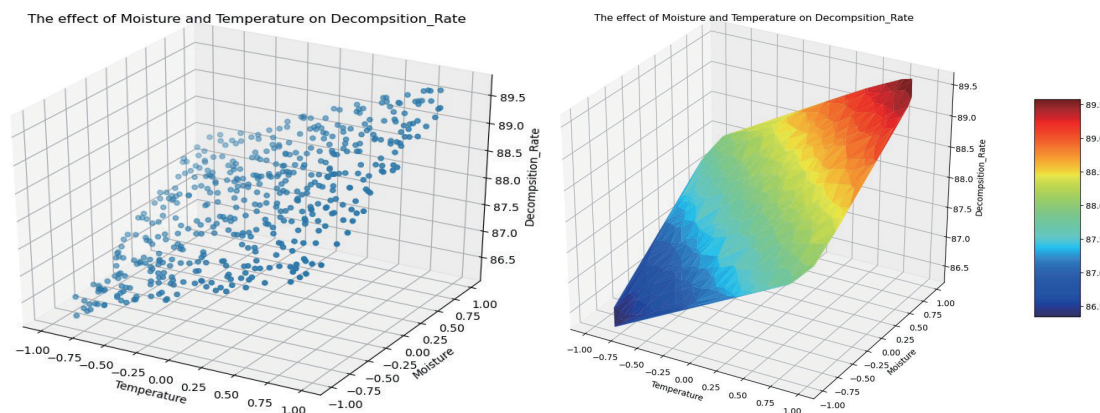


Figure 3. Both Temperature and Moisture Changes-1, Both Temperature and Moisture Changes-2

3. Conclusion

Our model is based on the basic population competition model, named the Lotka-Volterra model, and we extend it somewhat by applying it to represent the dynamic behaviors of decomposition ability over time in a fungal system. We consider a range of factors affecting the system, not only the inherent properties of the fungi themselves such as their hyphal extension rate and moisture tolerance, but also external factors such as the interaction between different species

of fungi, and the role of the external environment such as temperature and moisture on the system. By understanding the factors that influence the decomposition ability of fungi through our model, we can have a better understanding of fungal biodiversity and the important role it plays in the Earth's carbon cycle.

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A Brief Discussion on Wide Area Security and Stability Control of Power System Based on Response

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Abstract: At present, with the continuous development of China's social economy, the scale of domestic power system has been further expanded, which also makes the structure of China's power grid system gradually become more complex^[1]. Therefore, it is necessary to continuously increase the single unit capacity of power equipment. The purpose is to make the single unit capacity match the operation of power system, so as to improve the operation performance of power system. Besides, it can also increase economic benefits. Based on this, this paper expounds the concept and control mode of power system stability. Then the key technology of wide area security and stability control of power system based on response is analyzed from four aspects. They are wide area dynamic feature information extraction, disturbed trajectory prediction, system stability discrimination and stability control. Finally, the practical application is discussed in detail. It hopes that the power sectors can improve the stability control level of power system wide area security.

Key words: power system, security and stability, wide area control technology, application

1. Introduction

In the current social development, the most important energy is electricity because of that electricity plays a huge role in people's life and economic construction. In addition, the main cause of large area and long time power outage is the lack of stability of power supply system. It will not only cause certain losses to the economy, but also have a serious impact on social development^[2]. Therefore, the research on the security and stability control of power system can make the allocation of power resources more reasonable and improve the transmission capacity of domestic power system continuously.

2. Overview of security and stability control of power systems

2.1 The related concepts of power system stability

On the one hand, the function of power system provides uninterrupted power to users. On the other hand, the function of power system ensures that the power supply has a certain stability in voltage and frequency^[3]. Therefore, the requirement of power system performance should not only have high safety and stability, but also have certain reliability. Specifically, the reliability of the power system mainly provides long-term operation of electricity. And it can continue to provide users with adequate power services. For the security of the power system, it is mainly able to maintain the normal operation of the power system in the event of power supply risk and power failure. In addition, the stability of the power system mainly ensures the continuous and stable power supply.

2.2 Classification of safety and stability control mode of power system

There are different kinds of security and stability control modes in power system because of that the power system has different ways of information collection, transmission and decision-making. First of all, for the local control mode of power system, there is a lack of effective information exchange between plant stations because of that the control device is installed in different plant stations. The local control mode needs to use the switching and judging the existing information of the station to solve the problems of the station effectively. Secondly, for the centralized control mode, it not only has a relatively independent communication and data acquisition system, but also can carry out the overall control of the dispatching center settings. The running state of the system can be detected in time. And the corresponding control strategy can be formulated. The security and stability of the whole system can be improved through the issuance and implementation of control commands^[4]. Finally, for the regional control mode of power system, its main control is the power grid security of fixed area. It is necessary to install control devices in multiple power plants in order to control the stability of the power system in the fixed area. The information between power plants can be exchanged with each other by the transmission and implementation of control commands. And the security and stability of power system in a large range can be controlled effectively.

3. Key technologies of wide-area security and stability control of power system based on response

3.1 Information extraction of wide area dynamic features

The information of wide-area measurement information is large because of that the wide-area measurement information not only has global features and real-time features, but also has certain continuity. When the wide area security and stability of power system based on response is controlled, the most important work is to understand the characteristics of system security issues fully, and to judge and select the wide-area dynamic characteristic information which is in line with the safety and stability of the system from a large number of measurement data. For example, when the power angle stability is judged, the information includes power-power angle characteristic curve, Kinetic energy of generator–power angle curve, and angular velocity–power angle phase trajectory^[5]. At the same time, the bus voltage of the power-current curve and the frequency stability of the frequency trajectory curve should be judged. The control of wide area security and stability is realized.

3.2 Prediction of disturbed trajectories

Disturbed trajectory prediction is mainly used to predict the situation of the system after the security is disturbed. Its purpose is to understand the change trend of the system disturbed by the prediction, and to judge the security and stability of the system in time. The sufficient decision-making time for emergency control of the system is ensured. It should be emphasized that the prediction of the safe and stable disturbed trajectory of wide area measurement information is mainly carried out by two methods. One is the non system mathematical model, and the other is the system model.

3.3 Discrimination of system stability

Fast, reliable and independent of the whole system simulation calculation of security stability discrimination is the key to effectively control the response-based power system across the security stability^[6]. The safety and stability judgment of the whole system simulation calculation which is fast, reliable and independent is the key to control the safety and stability of power system crossing based on response. In the control of wide area security and stability of power system, it is not only necessary to screen the real-time measurement information effectively, but also to judge the power system security stability including transient angle stability, dynamic angle stability, voltage stability and frequency stability in real time. Besides, when the stability of power system is judged, the dominant instability mode

also should be given. It can judge the different analysis methods of safety stability effectively. It can identify the stability of wide area real-time measurement data, and realize real-time decision-making and control of power system security and stability.

3.4 Stability control

The response-based wide area security and stability control should be based on stability prediction. In case of system instability, the stability of the system can be guaranteed by taking control measures in time. Therefore, for the control of security and stability based on wide area measurement information[7], it is necessary to carry out quantitative analysis of the control measures on the one hand and the stability control measures should be optimized and perfected on the other hand. In addition, if the control quantity is insufficient and the stability property changes during the implementation of the control measures, the measures should be taken in time to ensure that the security and stability of wide area based on response can be controlled effectively.

4. Application analysis of response based wide area security and stability control technology in power system

4.1 Construction of wide area security and stability control system for power system

In order to make the power system have the stability of continuous security, it is necessary to put the security of the power system in the first place in the design of the power system planning.

It is necessary to control the safety and stability of power system effectively through the construction of reasonable and preventive control scheduling means. It can effectively prevent turbulence in the power system and avoid the occurrence of large power outages^[8]. At the same time, the power grid structure and security defense system should be constantly improved. The security and stability control system of the power system is a comprehensive system engineering. When it is planned and designed, the structure design of power grid and the operation mode of power system should be considered comprehensively. Only in this way can the security and stability of power system be controlled comprehensively and effectively.

The security and stability control system of the power system not only includes the security of the power system before disturbance, but also includes the design of power system security and stability control system after disturbance. The whole power system consists of three lines of defense, the specific content is as follows^[9].

First line of Defense. It is mainly to cut off the fault components in time by using the relay protection mechanism when there is a safety fault. It can ensure the normal operation of the power system after being disturbed.

Second line of Defense. The main purpose of this line of defense is to prevent the destruction of stability effectively. The system parameters of serious over line are controlled effectively and timely by using the measures such as the stability control device and cutting machine, load shedding stability control and emergency power conditioning. It can ensure that the power grid can continue to operate stably when it is damaged by the fault.

The third line of Defense. This line of defense is mainly for emergency control of system collapse. It carries out emergency control for the power grid when it is unable to operate due to a variety of serious accidents by using the measures including system disconnection and re-synchronization. When the system crashes, it can ensure that the system can continue to supply power

4.2 Analysis of Wide Area Security and Stability Control Process in Power System

The power system has a large range of electrical changes, short duration and more cumbersome analysis and calculation. We should make full preparations before the accident to analyze the security control strategy of power system. It can ensure the safety and stability control effect of power system. In addition, the effective control of power system security and stability is mainly through online and offline ways to solve the problems of short power supply

duration and complicated analysis and calculation. For the online solution, it mainly analyzes the real-time operation status of power grid and the possible faults in the server online decision-making system. It effectively solves the problem that the wide area security of the power system is unstable by making corresponding control strategies[10]. In practice, this method has some difficulties. It is rarely used to analyze and calculate the actual data. For the off-line solution, it is relatively simple in practical application. It can work out the corresponding control strategy by analyzing and calculating the faults that the power grid may encounter in each state. Although this method is relatively simple, there are still great problems in calculation and maintenance, and it is difficult to adapt to the development and change of power grid effectively.

5. Concluding remarks

At present, the wide area measurement system of response measurement device is gradually improved and perfected. Through using the high-speed communication network, wide area control system of the power system based on response has been developed and applied. Therefore, in order to ensure the safe and stable operation of AC / DC interconnected power system in China, it is necessary to study the wide area control technology of power system based on response. At the same time, the super defense line of power system security and stability should be constantly improved and perfected. It can avoid large area blackout of power grid and ensure that the power supply system can operate normally. Finally, it can provide continuous power for users.

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The Application research of Genetic Algorithm in Image Processing

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Abstract: Genetic algorithm is an algorithm that searches for the optimal solution by simulating the natural evolution process. In the process of image processing, a lot of optimization calculation is needed, and the global optimization of genetic algorithm can solve this problem well. Therefore, this article introduces the basic idea of genetic algorithm and the specific process of genetic algorithm in the application of image processing is studied, and the genetic algorithm is used to determine the weights of characteristic value and image enhancement in the application of image retrieval, and finally it points out the problems existing in genetic algorithm.

Keywords: Genetic Algorithm; Image Processing; image search; Eigenvalue weight; Image enhancement

1. INTRODUCTION

Genetic Algorithm^[1] (GA) was designed and proposed by Professor J. Holland and his students in the United States in the 1970s according to the laws of biological evolution in nature. It is an Algorithm that searches for the optimal solution by simulating the process of natural evolution. When solving complex combinatorial optimization problems, genetic algorithm can usually get the optimal solution or approximate solution quickly, which has strong robustness and self-adaptability.

Image processing is a technology that uses computers to process images to meet people's specific needs. It is a process of image enhancement, segmentation, restoration, coding, recognition^[2],^[2] compression and other processing^[2],. Under the impetus of the development of information technology, image processing technology has provided help for the improvement and development of many industries. People's demand for image processing continues to expand, so the research on image processing is becoming more and more important.

Because the process of image processing needs to carry on a lot of optimization calculation to the whole image, and genetic algorithm has better global optimization characteristics, it can quickly get the optimal solution in the process of image processing, and at the same time reduce the error in the process of image processing.

2. The basic principles of genetic algorithms

The specific process^[3] of genetic algorithm^[3] are as follows:

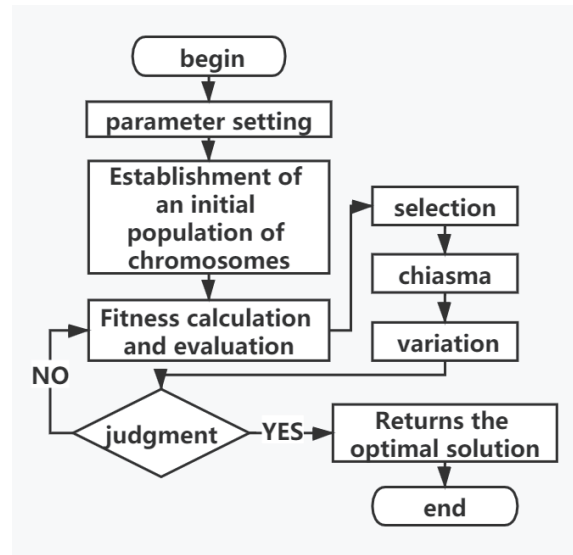
First, a population of N chromosomes is randomly generated, each of which corresponds to an initial solution to the problem and is represented by the same code. Then set some fitness function to calculate the fitness of each chromosome, and select the individual with the highest fitness in the population as the parents of the next generation population.

After that, two chromosomes of the selected chromosome group were selected in a certain way for crossover operation to generate two new chromosomes, and then a number of chromosomes were randomly selected according to

the set probability for mutation operation. When the mutation operation is completed, the fitness of the new generation population is calculated again, and the set convergence conditions are judged. If it is satisfied, the evolution is stopped and the optimal solution in the current population is returned. If not, the above steps are continued.

In essence, genetic algorithm is the continuous optimization of chromosome with bigger fitness generation by generation, and the individual fitness value is constantly increased, until the individual fitness value is close to the approximate solution that people need.

The algorithm flow^[4] is shown in the following figure.



3.Application of genetic algorithm in image processing

3.1Application analysis for determining eigenvalue weights in image retrieval based on genetic algorithms

In content-based image retrieval, the accuracy of retrieval is low because the manual setting of eigenvalues is subjective and arbitrary^[5]. The adaptive performance of genetic algorithm is better to make up for this shortcoming. Therefore, genetic algorithm can be used to automatically assign the weight of multi-feature combination in image retrieval so as to obtain higher image accuracy.

The feature values of image retrieval^[6] mainly include color feature^[7] and texture feature.^[6] The main N feature sequences were extracted from the feature combination set including color feature and texture feature, and normalized processing was carried out to binary code the chromosomes required by the genetic algorithm. ^[7]The number 1 represents the selection of the feature sequence^[8], and 0 represents the unselection of the feature sequence. Each chromosome corresponds to a unique set of characteristic sequences.

To determine the fitness function of the genetic algorithm, the sum of precision and recall can be used to improve the efficiency. Where, the precision is the ratio of the number of relevant images retrieved to the number of images retrieved; The recall rate is the ratio of the number of related images retrieved to the total number of related images.

For the selection algorithm, the adaptive proportion method or roulette algorithm can be used. The former will copy the excellent individuals in the population, eliminate the unsuitable individuals, and retain the best individuals, and select the weight that can produce excellent results. The latter means that the greater the fitness of the individual, the greater the chance of being selected will be, and the selected individual will enter the next generation population.

For crossover algorithm, a single point crossover method can be used to generate new individuals according to specific crossover probability. The crossover probability is usually selected from 0.45 to 0.99.

For the mutation algorithm, random bit mutation can be carried out on the individuals in the population. The

original is 1, the mutation is 0; where it was 0, it mutates to 1. The variation probability is generally 0.001-0.1.

There are various termination conditions for the algorithm, such as the accuracy of the solution or the maximum running time of the algorithm or the maximum iteration number of the solution.

The application process of genetic algorithm is as follow:

Step 1: select a certain database and a certain number of images of the same amount of each type as the query images, and set the appropriate number of images returned by search.

Step 2: Generate N bits of binary numbers randomly as individual codes, and a certain number of individual codes generated will be used as the initial population. The number of the initial population is generally 30-100.

Step 3: The fitness function is used to calculate the fitness of the individual and determine whether it meets the termination conditions of the algorithm. If so, the optimal individual and its optimal solution are output, that is, the optimal feature weight corresponding to each feature is obtained and the calculation is terminated. Otherwise, the process proceeds to step four.

Step 4: Chromosome selection, crossover and mutation through a certain algorithm to generate a new generation of population, and return to Step 3, until the termination conditions are met.

Through the above process, we can get the best feature weight corresponding to each feature and improve the efficiency of image retrieval. However, there are still many inadequacies, and there are still many places to be further improved. For example, the retrieval process only adopts the color feature and texture feature, but does not adopt the shape feature and spatial relation feature to further improve the retrieval accuracy. It can be seen from Jiang Xue's experiment^[9] that different databases use different eigenvalues, and the combination of eigenvalues obtained by using the genetic algorithm is corresponding to the database used in the process of the genetic algorithm, that is to say, the combination of eigenvalues is only applicable to the database relative to it.^[9]As the database is constantly updated and the number of images is increasing, the accuracy of the combination of eigenvalues will also decrease.

3.2 Application analysis of genetic algorithm in image enhancement

Image enhancement is a key research direction of image processing. On the one hand, it can effectively improve image quality, eliminate image noise and improve the overall quality of image. On the other hand, it can highlight the key part of the image, strengthen the image interpretation and recognition effect, and meet the needs of some special analysis. Image enhancement can be divided into two categories: frequency domain method and spatial domain method. The former adopts the low-pass filtering method to remove the noise in the image or the high-pass filtering method to enhance the high-frequency signal such as the edge, which is used to make the fuzzy picture clear. The latter adopts the local average method or median filtering method to remove or weaken the noise.

Image enhancement requires user intervention and cannot be performed adaptively. However, in the study of Lu Limin and Zhou Haiyin^[10], image enhancement process is regarded as an optimization process of image sequence, and image enhancement is transformed into parameter optimization, which is in line with the basic idea of genetic algorithm optimization, and the problem can be effectively solved through the strong adaptability of genetic algorithm. In this paper, the image parameter model proposed by J.S. Lee is used to transform the enhancement process of digital image into the process of seeking the optimal parameter k, and the binary coding, small population, large crossover rate and large mutation rate are adopted to improve the operation speed of the algorithm. The SNR and absolute mean error were used as fitness functions, and the maximum number of iterations was set as termination conditions. Through the commonly used genetic algorithm of survival of the fittest, the automatic image enhancement based on genetic algorithm is successfully realized, and the signal-to-noise ratio and absolute mean error is obviously better than the traditional image enhancement methods.

4 CONCLUSION

To sum up, genetic algorithm has a good application in the process of image processing, which solves the problems

of low efficiency and low accuracy of traditional algorithm to a certain extent, and provides a better optimization method for image processing.

But even so, there is still plenty of room for improvement. Genetic algorithm itself also has a lot of problems, for example, most of the genetic algorithm used in the application of the code is binary code, which limits the application of genetic algorithm through other ways of coding. Genetic algorithm can select and improve its code appropriately based on different application situation; Secondly, the parameters of genetic algorithm need to be selected at the beginning of its application. The selection of different parameters will greatly affect the performance of genetic algorithm. Moreover, the current theoretical research can not fundamentally solve the two most prominent problems of precocious convergence and poor local search ability.

In a word, genetic algorithm still has a lot of room for development in theoretical development and practical application. In the future, due to the development of mathematical methods and computer performance, the research of genetic algorithm will get greater progress, and the application of genetic algorithm will be more extensive.

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Influence of different angle of spoiler fin at specific position on vehicle aerodynamics

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Abstract: The significance of Aerodynamic Research on automobile is not only to improve the high-speed driving stability and crosswind stability, but also to reduce vehicle fuel consumption. As an additional device, the rear spoiler has shown a good effect in the external components of the automobile, so the reasonable design and assembly of the rear spoiler is particularly important. The rear spoiler with proper height can effectively reduce the air drag coefficient and lift coefficient. This paper mainly uses the software ICEM, Fluent and Post in ANSYS to analyze the influence of different angles of the specific spoiler on the aerodynamic performance of the vehicle. In the software experiment, I adjusted the spoiler angle and car speed and I found that in a certain range, the downforce generated by the spoiler is proportional to the angle between the spoiler and the ground.

Keywords: Automotive Engineering, computational fluid dynamics, aerodynamics

1 Introduction

Before that, there has been a lot of research on the car spoiler. Many mature research results have been widely used in the field of automotive engineering. Fu Limin (2010) states that the results of previous studies have shown that the medium pressure differential resistance in pneumatic resistance of cars accounts for 85% of the total resistance, and the pressure differential resistance, in turn, has a close relationship with the wake structure of cars.^[1] So I think the research on the spoiler is very important and has a wide application prospect. Among them, I found that the clear relationship between spoiler angle and downforce is not given in many data. I'm going to use the experiment to explore this relationship and find the best angle of the spoiler. In my experiment, I will use the given car and spoiler model to simulate. The car model and selected spoiler model is shown in Figure 1. The model is a closed entity. Because there are a lot of small features on the surface of automobile, it is a big obstacle to mesh. Therefore, it is necessary to simplify the model and transform the surface into a plane as far as possible. Then, a cuboid is set up as the calculation domain, and half of it can be taken for calculation due to its symmetry.

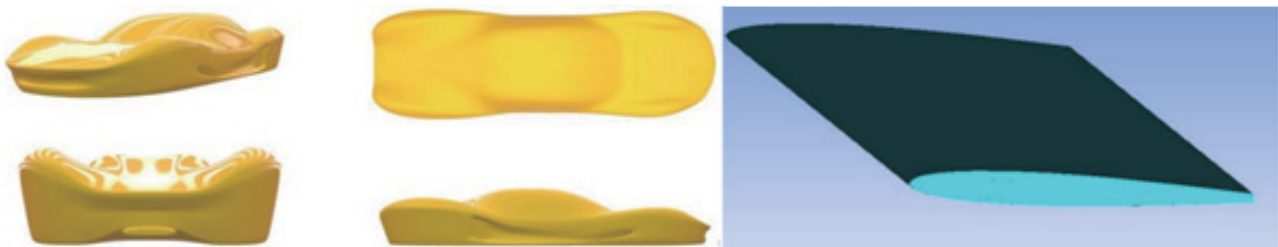


Figure 1 (Selected model)

Based on the experiment documents given, I can determine the spoiler shape relative to the car and the spoiler. As shown in Figure 2, the spoiler should be installed at position 17 with coordinates (- 70, 0, 70) relative to the origin.

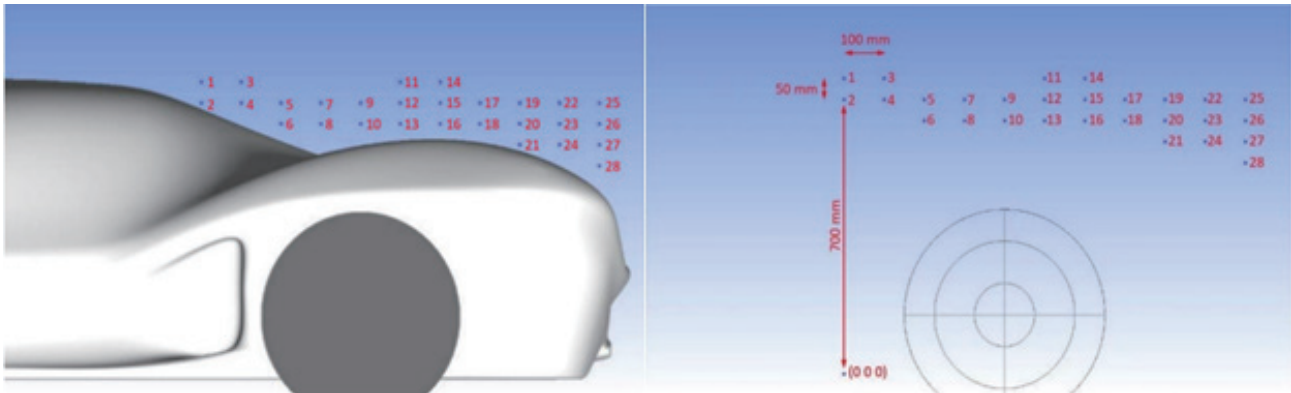


Figure 2 (relative position of spoiler and vehicle)

2 Methodology

2.1 Mesh building

First, I download the STL files of the given car and spoiler and import them into ICEM. Through ICEM, my installation files require that the angle of the spoiler and the relative position of the spoiler and the car be adjusted. Note that this process needs to be repeated five times to get a grid of different spoiler angles, which are 30 degrees, 25 degrees, 20 degrees, 15 degrees and 10 degrees.

Through ICEM's measurement program, I measured the maximum size of the vehicle model is 340X140X85. According to this data, I built a cuboid with the calculation domain size of 2000x800x800 and the initial point of (800, 0, - 6), as shown in Figure 5. In the computational domain, I created a body named air, which stands for air. After that, I will name the faces of the computational domain separately, so that the boundary can be set later. Then draw the curve of the junction of the solid, I can start the mesh setup.

The first is the global mesh setup. After trying, I set Max element to 80 and min size limit to 0.4 (figure 5). The second step is to set prism meshing parameters, Initial height 0.9, Height ratio 1.15, Number of layers 5 (figure 5). The third step is to perform part mesh setup (figure 6). After creating two density area, I started to compute the mesh. The mesh quality under the condition of 30 degrees and 30 m / s of completed mesh is shown in Figure 7.

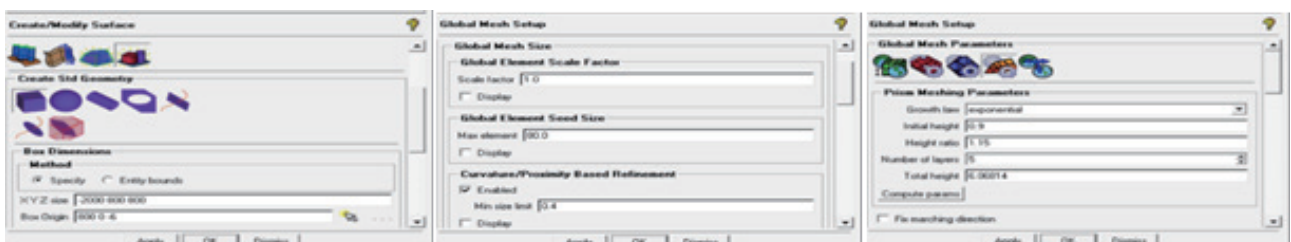


Figure 3 (Setting)

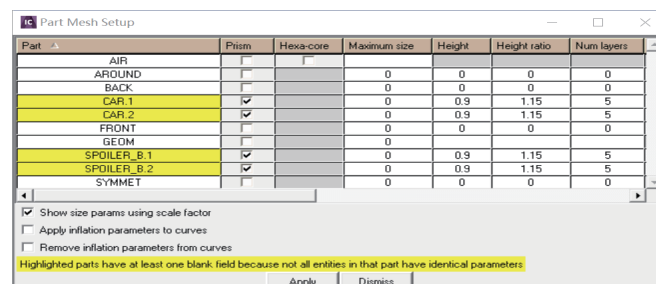


Figure 4 (Part mesh setting)

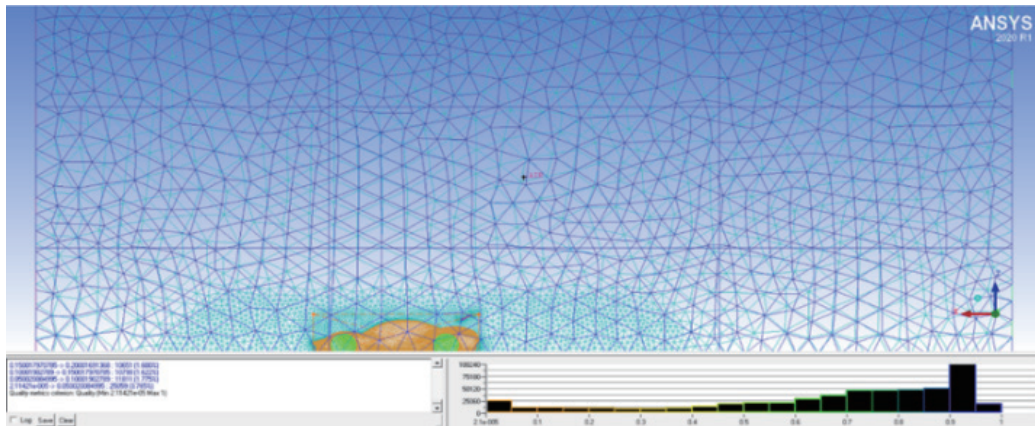


Figure 5 (Mesh quality)

In addition, in order to prove the effect of the spoiler on the car, I also set up a control group with only the car model and no spoiler model.

2.2 Fluent computing

$$\frac{\partial \mathbf{u}}{\partial t} + (\mathbf{u} \cdot \nabla) \mathbf{u} = -\nabla p + \frac{1}{Re} \nabla^2 \mathbf{u}$$

$$\nabla \cdot \mathbf{u} = 0$$

$$\nabla = \left\{ \frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z} \right\}^T \quad \nabla^2 = \left\{ \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} \right\} \quad \mathbf{u} = \{u, v, w\}^T$$

Import the mesh to fluent for calculation. 3D solver is used to solve the problem, and SSK k-omega equation model is selected as turbulence model. Given the boundary conditions, the inlet velocity is $u = 30 \text{ m/s}$, $u = 40 \text{ m/s}$, $u = 50 \text{ m/s}$, $u = 60 \text{ m/s}$, $u = 65 \text{ m/s}$. Select intensity and visibility ratio in the inlet boundary setup. Set the visibility ratio to the default value of 10%. The three-dimensional incompressible Navier Stokes equations commonly used in engineering are used here.

“Where: u, N, w -x, y, z direction component: p -pressure: re Reynolds number, $re = H / V$: u -average velocity of channel flow, h -distance from channel center line to wall surface: y -coefficient of motion viscosity.”^[2]

The residual calculation is performed for five times, and the curve reports of the stress on the car body and spoiler in Z direction are generated respectively. After the calculation, 25 CAS and data files were exported in turn. The residual curve and the overall force curve of the car under the condition of 30 degrees and 30 m / s. (Figure 7)

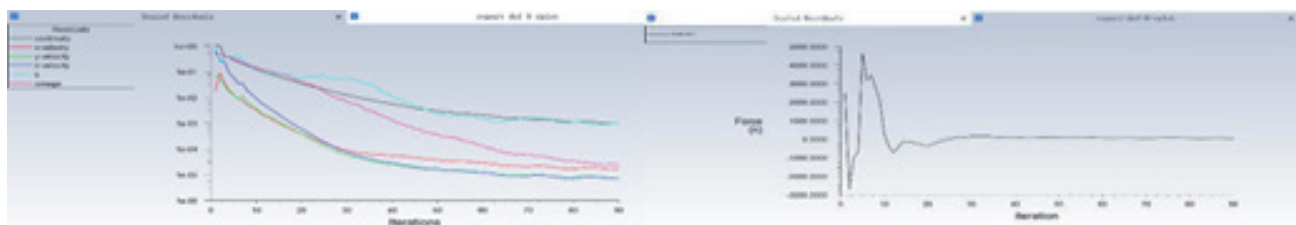


Figure 6 (Residual curve and overall force curve)

3 Results and discussion

3.1 results

By outputting the results, I get the data. By calculating these data, I get the model rise force.

Rise Force (N)					
Speed Degree	30M/S	40M/S	50M/S	60M/S	70M/S
30 Degrees	69.34286	133.839	219.5943	281.1406	403.1017
40 Degrees	97.07742	156.3547	252.3375	362.3021	445.6705
50 Degrees	117.6753	179.9498	264.9781	306.7306	476.1981
60 Degrees	118.1872	170.8535	241.6082	449.3911	525.6961
65 Degrees	134.1327	247.6101	391.0025	566.6053	655.4968
No Spoiler	174.6341	285.9204	518.6639	735.2431	906.6973

By comparing the rising forces of different angles at the same speed, the following curve can be obtained.

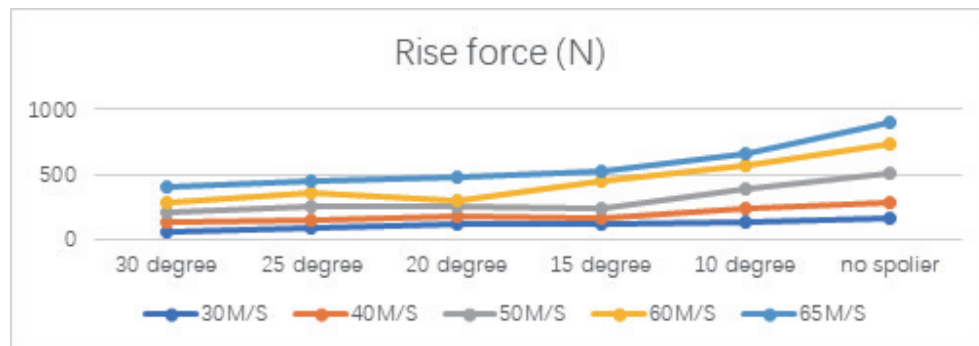


Figure 7

It can be seen from this picture that in the range of 0 to 30 degrees, with the increase of the spoiler angle, the downforce of the car increases. The downforce of the spoiler is proportional to the speed of the car. In addition, the installation of the spoiler will provide additional downforce to the car.

I also measured the resistance of the car in the X direction and got the following curve.

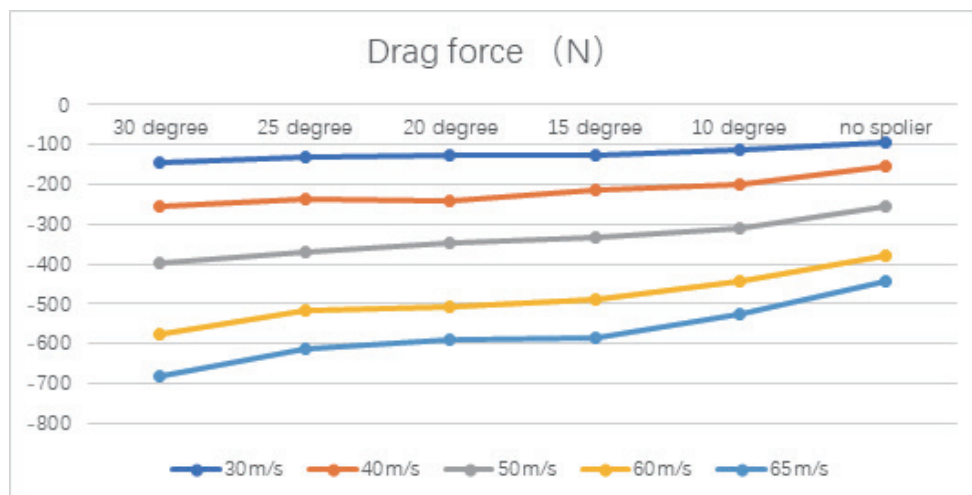


Figure 8

It can be seen from this picture that in the range of 0 to 30 degrees, with the increase of spoiler angle, the resistance in X direction increases. The resistance of the car in the X direction is proportional to the speed of the car. In addition, the installation of the spoiler will provide additional resistance to the car.

4 Conclusions

It is clear that at the same speed, the rising force increases with the decrease of the spoiler angle in the range of 0 to 30 degrees. In addition, the lifting force of the model without spoiler is much greater than that of the model with spoiler under the same condition. This means that under the same conditions, in the range of 0 to 30 degrees, the downforce of the car is proportional to the spoiler angle. Therefore, the best angle of the spoiler to increase the downforce is 30 degrees. However, we can also conclude that while providing the maximum downforce, the 30degree spoiler also causes the maximum resistance in the X direction. Therefore, whether the 30degree spoiler can provide the best effect when the car is running still needs further test.

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Safety Problems and Preventive Measures in the Operation of Power Distribution Network

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Abstract: With the increasing application of power equipment and the increasing demand for market power, on the one hand, it accelerates the development of power enterprises; on the one hand, it also makes power distribution face great pressure. In the case of large amount of power consumption, the safety problems of some equipment not only affect the safety of distribution network, but also bring security threats to equipment users. In order to accelerate its own development, power distribution enterprises must do well in the safety management and maintenance of distribution network, so as to ensure the safety and reliability of power distribution. This paper introduces the importance of safe operation of distribution network, analyzes the problems existing in the safe operation of power distribution network, and actively explores the countermeasures of power distribution network safety management.

Keywords: Power; Distribution Network; Safety; Countermeasures

1. Importance of safe operation of distribution network

The power production and distribution flow chart is shown in Figure 1 below.

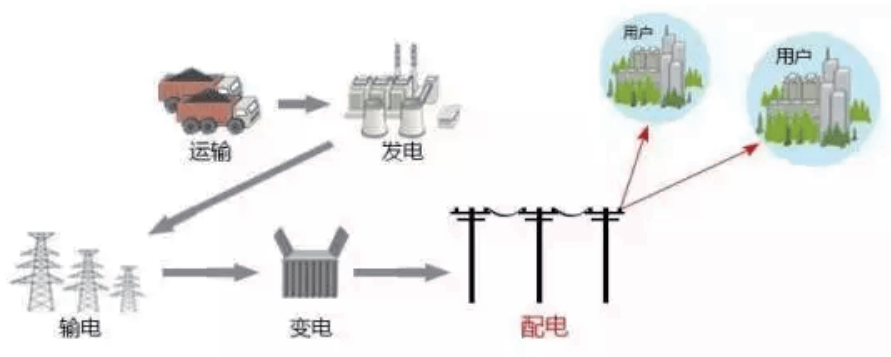


Figure 1. Power production and distribution flow chart

Generation, transmission, transformation and distribution, direct connection of distribution to users is a key part. The safe operation of power distribution network is very important. Strengthening the safety prevention and control of distribution network can effectively promote the smooth completion of relevant projects and ensure the quality of distribution projects^[1]. In fact, the safety prevention of distribution network is a complex work. The corresponding operation is affected by many factors, which requires technical guarantee and reliable construction process. Therefore, the safety prevention and control of distribution network is needed. In the operation of distribution network, the power equipment and technology involved are relatively diverse. Strengthening safety prevention and control and management

can also reduce the failure and damage rate of equipment, improve the use effect of equipment, and extend the service life of equipment, etc., which also plays an active role in promoting the safe operation of the power grid and improving the economic benefits of distribution network operation.

2. Safety problems in power distribution network operation

2.1 Safety problems caused by unreasonable design of distribution network

Compared with other types of engineering construction, the construction period of distribution network is generally longer. At the beginning of the design of power distribution network in many areas, the future development and demand of power distribution were not taken into account. Therefore, in the early design, the compatibility and expansibility of the distribution network were not considered. As a result, with the increasing number of power equipment in the later stage, the pressure on the distribution network was also increasing, and eventually the distribution network could not bear the huge power load and affect its safe operation. In the design of distribution network, due to the lack of overall thinking, the distribution network faces a lot of difficulties in the later maintenance and overhaul, which will also lead to the increase of the probability of safety problems. At present, in the design of domestic distribution network, the radioactive network structure is often used. This kind of distribution network can meet the needs of power supply, but its reliability is not high in the specific operation. Because of the lack of interoperability between radioactive network lines, if a line fails or is abnormal, it may lead to the normal operation of the whole distribution network, raising security issues^[2]. In the final analysis, there is a lack of rationality and overall planning in the design of distribution network.

2.2 Imperfect management and maintenance mechanism of distribution network

There are many security problems of distribution network that do not happen suddenly. If some small faults and anomalies are not handled in time, they will lead to bigger problems, and even cause the security failure of the whole distribution network^[3]. In addition, in the operation of the distribution network, some parts are in the constant aging process with the passage of time. If they are not replaced and maintained in time, it will lead to the safety failure of the distribution network and cause safety problems. As far as the current management of power distribution network is concerned, the corresponding maintenance work is not actively carried out. Most of the time, the reasons are found after the problems of power supply and equipment, which affect the safe and orderly operation of the power grid. At present, the safety management and maintenance system of relevant power distribution network enterprises has been established. However, the relevant maintenance system is updated slowly, and some management and maintenance mechanisms have fallen behind, which leads to the lack of specific standardization in the current distribution network safety management and maintenance, and the problem of safety failure cannot be effectively reduced.

3. Countermeasures for problems in operation of power distribution network

3.1 Optimizing distribution network design and improve system compatibility

At present, the scale of the distribution network is expanding. In the design of the distribution network, we should consider the development trend of the current power market and the future distribution demand. In the design, we should appropriately expand the system capacity, optimize the distribution structure, improve the system compatibility, and carry out the overall design of the distribution network. At the same time, we should also consider the later operation, service and maintenance. Considering the maintenance and other work, a reasonable distribution network structure should be designed to promote the continuous improvement of system compatibility. As shown in Figure 2 below, it is the diagram of distribution network detection system^[3].

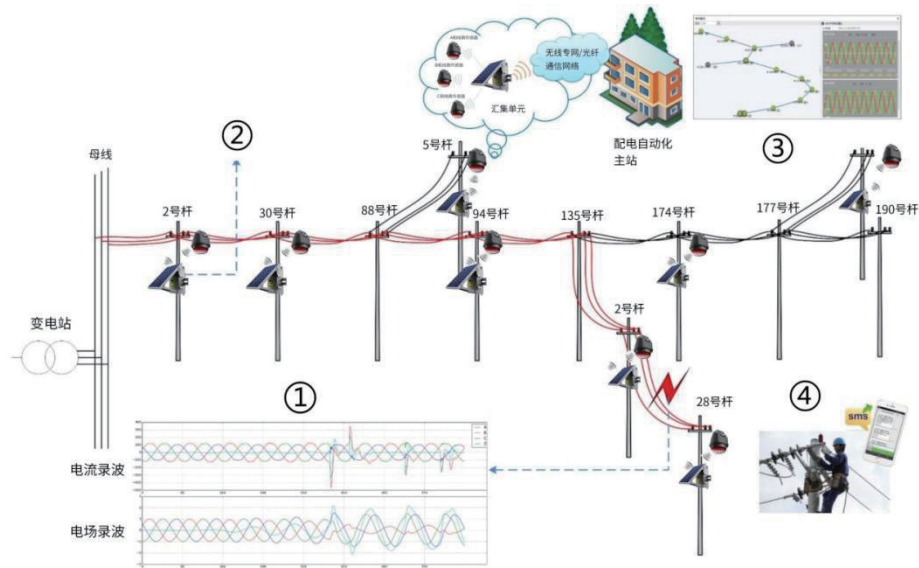


Figure 2 Distribution network detection system diagram

By setting up the state detection system in the distribution network, the operation state of the distribution network can be detected in time, and be grasped dynamically, so as to take precautions.

3.2 Strengthening the maintenance work of distribution network and find problems in time

The security of distribution network is of great importance and needs to be paid more attention^[4]. In this regard, the enterprise should actively improve the power distribution network maintenance system, and strengthen the management and maintenance of the distribution network. In view of the problems of long-term transformation, aging of lines, poles and porcelain bottles, and the power failure of the line in case of severe weather, the company can conduct a comprehensive arrangement of the line, and include all the departments required for eliminating the shortage of the line in the operation plan, and replace the porcelain bottles and cables in three groups, adding new pole to adjust sag work and preparing for the war in a "combat" state^[5]. First, a "centralized maintenance front-line operation room" is set up to formulate a centralized maintenance operation plan of "fighting against the distribution network". Six operation teams were set up, including on-site safety control, operation plan control, maintenance material management, engineering quantity supervision, user equipment control, field reporters and logistics support, in order to formulate operation plans and design routes in the way of reverse schedule. The "operational command order" is used to issue the plan and task in a unified way, and the head of each department and the director of the power supply station are taken as the first person responsible for the maintenance work. We adhere to the principle of "one game for the whole situation, one shot for the whole battalion", resolutely implement the combat plan, effectively reduce the failure rate of the distribution network, and improve the safe operation efficiency of the distribution network.

4. Conclusion

The safe operation of power distribution network is the key to ensure the safety of power consumption and equipment. In terms of the current safety problems of distribution network, the relevant grid design is unreasonable, which leads to the safety problems in the operation of distribution network. In addition, the imperfect safety management and maintenance system of the relevant distribution network also leads to the increase of the probability of safety problems. Therefore, measures should be taken as soon as possible, optimizing the distribution network water, and strengthening the maintenance work of the distribution network, so as to effectively improve the compatibility and safety of the distribution network, ensure the safety of transmission and distribution, and reduce the power grid failure to improve the market competitiveness of the power distribution network enterprises.

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Analysis on Design and Optimization Measures of Automobile Electronic and Electrical Architecture

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Abstract: With the development of society and economy, cars have become an indispensable means of transportation for people's daily life and work. Improving the performance of automobiles and providing people with a safe and comfortable riding environment have become the key development goals of the automobile industry. This paper takes the electronic and electrical structure and optimization measures of automobile as the research object, and provides reference for automobile development by studying the electronic and electrical structure and optimization process.

Keywords: Automotive electronic and electrical; Architecture design; Optimization measures.

1. Introduction

In recent years, with the rapid development of our country, the total number of cars in China is constantly increasing, which makes cars become a very convenient means of transportation chosen by people and brings the most convenient travel for people. In China's current automobile manufacturing industry, automobile electronic and electrical architecture design is one of the most critical factors affecting automobile design. In the process of automobile development, the functions of automobiles are increasing, and a large number of communication lines are used in automobiles, thus building a complex electronic and electrical control system. In order to make the electronic and electrical control system run normally, on the one hand, the design content of electronic and electrical architecture is simplified, on the other hand, effective optimization measures are implemented according to the service performance of automobiles.

2. Analysis of main optimization tools for automotive electronic and electrical architecture design

2.1 Database

The optimization of database is divided into three aspects: First, in the design of electronic and electrical architecture system, the database should be optimized comprehensively to make it meet the design standards. Under the background of global economic integration, in the production process, automobile enterprises will constantly optimize the models and structures according to the industry trends and drivers' needs, and establish a perfect database in the optimization, so as to provide reference for subsequent production; Second, designers should adjust the database in real time, analyze the development trend of the automobile market from a development perspective, and formulate a scientific and reasonable design scheme of the electronic and electrical architecture system through the database, which is conducive to improving the operation level of the electronic architecture system; In the optimization of automotive electronic and electrical architecture design, it is very important for us to optimize the architecture database, which plays

an important role in automotive electronic and electrical architecture design. If the architecture database can not be done well, the automotive electronic and electrical architecture design will become meaningless, because the authenticity of data is very important in the process of optimizing database design.

2.2 Tool for optimizing the design of electronic and electrical architecture

Optimizing the design of electronic and electrical architecture can better assist people to carry out related work. For the current development, tools play an increasingly important role. Because the development of the automobile industry is becoming more and more complex, we should introduce information technology and improve the design work, which can improve the overall design effect, accurately grasp the design accuracy, and better promote the related work. Automobile manufacturers need to constantly improve relevant work and use relevant tools reasonably. Based on the concept of electronic and electrical architecture design, we can effectively combine various elements with relevant tools, which can improve the design quality. We can also define electronic and electrical components. According to different situations and the positions of different components in automobiles, we can establish different development modules, play the role of different modules, and strengthen the links between modules, which can achieve better results, thus further improving the design of automobile electronic and electrical architecture and ensuring the quality of automobile production.

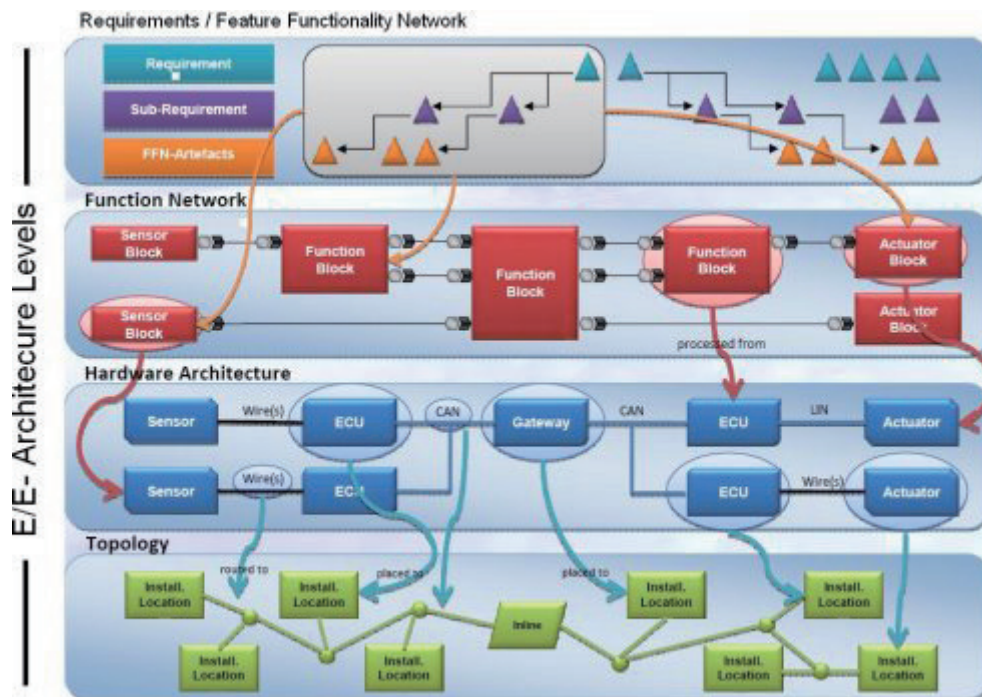
In the process of automobile electronic and electrical architecture design, only by using appropriate design optimization tools for electronic and electrical systems can the effective implementation of various electronic and electrical architecture optimization and management work be ensured, and then scientific configuration settings be realized. Therefore, in the process of electronic and electrical architecture design, designers should give priority to some advanced and representative electronic and electrical design optimization tools with relatively mature technology, such as vision and PREE. The advantages of the above tools are that they generally have database support systems and graphical user interfaces, and the relevant design results can be reused in the tools, and they also have the functions of relearning and modifying electronic and electrical construction.^[1]

3. Analyze and optimize the process of designing automotive electronic and electrical architecture

3.1 Positioning of market models

Optimizing the process of designing automotive electronic and electrical architecture is very important for our next development, and it also plays an important role. First of all, we should do a good job in positioning market models, so as to determine the development direction. When planning the market, automobile enterprises need to know the current market development in detail and monitor the specific market dynamics in real time, so that we can grasp the latest development trends and make reasonable evaluation, so that we can carry out related work from different aspects. The design appearance, market pre-sale situation and other aspects of work need to be positioned reasonably. We can optimize and do a good job in research, which can better overcome the problems, help the automobile industry to do a good job in future planning, adjust and design the plan through relevant information, achieve better development, master the latest development process, and play a guiding role in the development of the automobile industry, which can reduce the occurrence of problems and achieve better results.

In the process of vehicle positioning, the strategic department of the enterprise should go deep into the market for investigation, and cooperate with the market planning department to launch brand-new vehicles, so as to conform to the market development trend on the one hand and meet the needs of drivers on the other hand. In the process of market model positioning, based on the changes of the future market, the market should be comprehensively analyzed and evaluated, so as to accurately position the model, make the model more reasonable and occupy a dominant position in the market. After the model is determined, the design of electronic and electrical architecture system can be started.



3.2 Correct analysis of benchmark models

It is also a very critical step to analyze the benchmark models accurately, which plays an important role in the whole vehicle design, and plays a role in benchmarking management. We can optimize the related work of automobile electronic and electrical architecture design by understanding the need of benchmarking management in detail and then considering it comprehensively. On the basis of comprehensive consideration, we can innovate the power supply system, topology and other related work, so as to create better models, meet our current development needs and achieve better results. When analyzing the relevant benchmark models, we need to analyze them comprehensively, not only to see its advantages, but also to find its shortcomings, so that we can better grasp the key to development. Effectively solve these problems, and accurately apply the benchmark models, so that we can continue to innovate and grasp the key of design according to our own development. By integrating various elements, we can achieve better results, improve the design of automotive electronic and electrical architecture, improve its performance, advance related work, and master the latest development contents, thus further realizing the development of modernization. In the future development, we can achieve breakthroughs and get inspiration from benchmark models, which is a major breakthrough for the development of China's automobile industry. We must master more information from them and break through traditional construction from different aspects, so as to adapt to the development of the times and achieve higher development goals.^[2]

3.3 Design the vehicle type according to the specific market demand

The design of vehicle models also needs to be carried out according to the specific market requirements. Only by doing relevant work according to the market demand can we fully meet the customer's needs and increase the sales volume of automobiles. On the basis of the customer's needs, we can reasonably arrange the design of automobile electronic and electrical architecture, reasonably carry out relevant work, and improve the performance of a certain aspect in a targeted manner, which has become an important basis for automobile manufacturers to produce. We can analyze the needs of users, innovate constantly on the basis of diversified development, improve the configuration of cars, and choose appropriate development methods to design different models reasonably, so as to achieve better results. We must proceed from reality and do relevant work well. It can further promote the development of the automobile industry in meeting the needs of users, and the process of modernization is constantly accelerating. Only by having a

certain ability can we cope with different problems, and we can master more technology and development experience from it, and constantly innovate on the original basis to meet the development of enterprises. In the process of vehicle positioning, the designer should make a comprehensive analysis according to the customer's needs, on the one hand, meet the customer's needs to the greatest extent, on the other hand, comprehensively improve the performance of the vehicle, and fully display the characteristics of the vehicle, so as to attract the customer's attention. In the preparation of the new car leaving the factory, the vehicle type should be fully tested to make the vehicle type more reasonable and help meet the use demand. After completing the demand development of the vehicle type, the relevant components are reasonably configured on the basis of the vehicle type to effectively control the cost of the vehicle type. If the configuration is improved, the cost of the vehicle type will be increased. According to the demand, the cost of vehicle can be controlled in an effective range.

3.4 Keep up with market demand, introduce new technology and give play to the role of modern technology

Optimizing the design of automobile electronic and electrical architecture can strengthen the stability and safety of automobile design, and there are more solutions when problems are encountered in use. At present, the development of China's automobile design needs more growth. The design of automobile electronic and electrical architecture is a very complex work, which combines various technologies and knowledge, and needs to give full play to the role of information technology. In the optimization process of automotive electronic and electrical architecture design, it is necessary to select suitable optimization tools to ensure the scientific and rational design optimization of electronic and electrical architecture, ensure that all electronic and electrical architecture design optimization can be accurately implemented, and enhance the scientific configuration of architecture. Master more good methods, effectively solve the problems and better carry out related work, so that we can improve our own development and provide more development ways for the automobile industry. We should find our own development methods, stick to our own development ideas in this process, improve our work from different aspects, introduce more knowledge about electronic and electrical architecture design, and further improve tools and construction methods, so as to achieve the expected goals and develop in this process.

According to the specific situation, China's automobile industry is still developing constantly, and has made good achievements in some aspects. We should constantly break through the tradition and improve the development level of designers, so as to achieve better results. It can make tools play a better role, and the system can be reasonably applied in the actual development, so that the automobile industry can get more benefits and realize the development in different aspects, which has a positive effect on us. We can also learn a lot from it, build a complete development structure, enable the automobile industry to build a new development concept, and achieve a higher level of development in design, so as to achieve long-term development and provide more choices for people.^[3]

In the new development period, we must introduce advanced technology and the latest management experience, adapt to the development of the times and make corresponding improvements, so as to achieve better results and improve the overall development level. The design of automobile electronic and electrical architecture needs to keep pace with the times, which has an important impact on the development of automobile industry. We should not only grasp the key problems, but also put forward targeted problems. For different aspects of work, we should propose different solutions. In addition, we should always pay attention to all kinds of information about the development of automobile industry. We can absorb the factors that are beneficial to our own development and constantly improve the related work, so as to achieve practical results and further promote the development of related work. The related contents of automobile electronic and electrical architecture design need to be further developed. We should carry out according to relevant standards and improve our own development level from different aspects, so that we can obtain more benefits and improve the overall development effect.

4. Summary

The design of automotive electronic and electrical architecture has a great impact on the quality and performance of automobiles, and plays an important role in the actual development. What we need to do now is to deal with all the work and problems, build a complete development system, and deal with all the work in each link, so as to continuously break through the traditional construction and make greater contributions to the development of the automobile industry. Improving the performance of automobiles and bringing better experience to people can expand and develop the automobile market in China and achieve better results.

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