Multi-modal ocean intelligent computing across scales

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Review

Research Progress in Automation Science and Technology for Shipbuilding Engineering

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Abstract: With the complexity of international communication and transportation, the development of ship engineering has become a necessary task for China. The engineering is technically difficult and large in volume, so we should deeply study the application prospect and development trend of ships and promote innovation. In this paper, we will list some fruitful ship automation technologies and provide relevant scientific literature at the end of the paper. China should weigh the advantages and disadvantages of the technology, innovate and expand the advantages of the technology to make up for the shortcomings of the technical difficulty and variability, and in the future, we should also continue to deepen the research, integrating innovation and practice, exploring more applicable technologies, and promoting the ship engineering to the forefront of the world, and becoming the pride of our country.

Keywords: Marine engineering; Control systems; Positioning systems

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1.Introduction

With the rapid development of China's economy and science and technology, automation science and technology is also developing rapidly, and its application has become one of the most eye-catching high technology. China's ship marine engineering is also facing many problems to be solved, the two organic combination together, it will promote the continuous development of ship engineering practice, and continue to burst out of the new industrial revolution and the core technology of the ship. Ship also has many research points, for example, his control system includes all aspects, such as transverse rocking minus rocking fins, transverse rocking - wing fins, heading control, intelligent fault-tolerant system, all aspects are not just a single operation, but complementary to each other.

The positioning of automation science and technology is that of a technical science, an applied fundamental discipline, which provides the scientific theoretical foundation for the design, manufacture, control, and management of advanced automation systems such as computer-integrated manufacturing systems, as well as a series of control engineering applications in China's maritime domain. It offers highly innovative strategies for a range of practical engineering projects in China and is an indispensable and highly reliable advanced technology essential for building a future technologically advanced maritime power.The application field of automation is also very wide, not only used in aerospace and navigation guidance and control systems, but also used in automobiles and their integrated circuits and other manufacturing industries, of course, there are also closely related to people's lives in the chemical industry, pharmaceuticals, and other industrial control systems and communication systems, such as the telephone and telegraph systems, such as the Internet, which are used by the people day after day. It can be seen that automation has been deep into people's daily lives, even if we do not pay attention to deliberately, but a little more careful will always find that it appears in every corner of our lives.

Then we are going to explore the study of ships and marine engineering is divided into three major parts, respectively, the design phase, manufacturing phase, and the ship in the details of the adjustment stage.

First of all, the design phase, we automated in the study of engineering drawing is also known as CAD is very important, the emergence of these computer-aided software, making the ship design engineers more convenient to go to the design of the ship, but also more accurate expression of what they want to design the details of the ship and the relevant performance, which are to a certain extent to reduce the design of the mistakes and errors, the saving of resources is also very favorable, in short, all of the design phase, the design phase, the design of the ship and marine engineering is divided into three major parts. In short, it is a very efficient and flexible comprehensive application.

Next is the manufacturing stage, a large number of different materials, cross-section, curvature, etc. are shipbuilding must experience the problem, at the same time, know the basic shipbuilding knowledge also need to carry out the technical manufacturing, welding, grinding, painting, and so on need high technical requirements of the technology, automation series of technology and even robots can be accomplished better, which also fills the artificial welding, manual painting, etc. may not be able to meet the standards of shipbuilding loopholes. This also fills the loophole that manual welding, manual painting, etc. may not be able to meet the standards of shipbuilding.

Finally, I think the most important stage, that is, the dissemination of the details of the adjustment stage. Every ship has a lot of hidden details in it, and it is by no means a ship that is made in a macroscopic way, but it mainly relies on a variety of small parts in it to trigger its relevant roles. Ships need to navigate and communicate, need to operate and need to be protected, combined with the automation technology I said above the areas involved, it is not difficult to imagine that the two can promote each other and develop each other, the technology is used in the ship, making the ship's communication and operation of intelligent, so that it becomes more reliable and more efficient. At the same time, the use of big data and high-tech in the ship is also conducive to the elimination of obstacles in the ship's system faults and other potential safety hazards, which greatly saves the time of inspection, but also makes people more in-depth development of the ship's marine engineering.

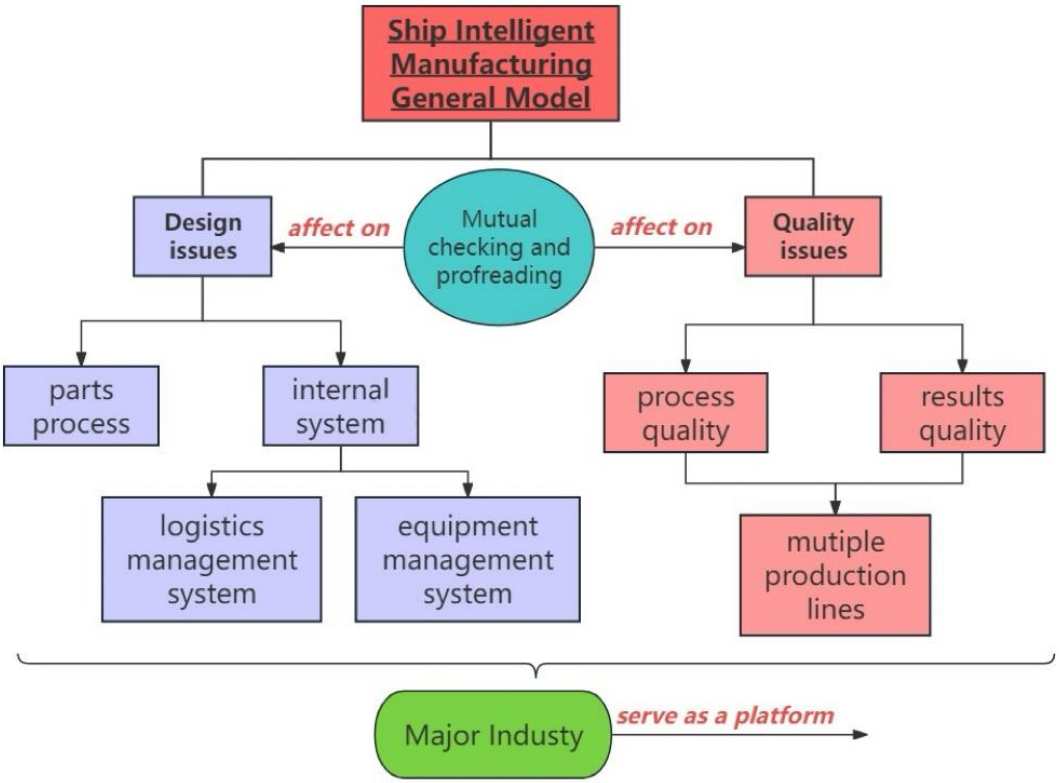

Figure 1: Research on the general model of ship intelligent manufacturing

(A)As can be seen from the figure, the knowledge of ship and ocean engineering and the introduction to automation is closely related and inseparable. In every process is not less intelligent science and technology, only in this way can make the whole ship run more smoothly and naturally, which will greatly promote the deep development of China's ship marine engineering technology.

(B)The purpose of this paper is to further reveal the connection between automation and ship marine engineering and to deepen the mystery of ship marine engineering. The operation of many different systems contained in the ship and the operation of its internal structure are analyzed, so that everyone can understand the ship as a substance more comprehensively and thoroughly. It also points out the potential problems and difficulties that may arise in the development of the ship, and in response to these difficulties, practically puts forward some potential development plans to provide practical and effective constructive suggestions for a more comprehensive improvement of the ship ocean engineering, and looks forward to the future development of China's ocean engineering. This paper has certain guiding significance for the development of China's ocean engineering field. This paper is a guide to what I consider to be the more meaningful personal recommendations for ship construction engineering.

2.Ship transverse rocking reduction fin control system

Systems such as deceleration fins were largely invented in the mid-twentieth century.When sailing and operating at sea, it is inevitable that bad weather will occur, which greatly threatens the safety of navigation. These storms cause the ship to move in many degrees of freedom, of which transverse rocking is the most likely to occur and the most harmful because of its extreme oscillation. In order to avoid the occurrence of this situation designers have designed a number of types of rocking devices, the most effective of which is the rocking fins, this thing was developed in 1889 by Johnny Croft, until today are being used, recognized as a major milestone in the history of ship sailing his distribution is also very wide, many countries, such as the United Kingdom, Denmark and other major countries are in use. But all things are in the progress of continuous improvement and development, PID control system for reducing the role of this system is very important, so people continue to improve him, and ultimately achieved a wealth of research results: so that the reduction of rocking fins, including the six control parts, which the ship is also divided into two categories, respectively, is fixed and stowed, and their different uses of course, looks different.

2.1 How the rocker reduction fins work

Ship in the wind and waves are prone to transverse motion, in the face of the control system and the disturbance of the waves, the ship will make the corresponding rotation, by physics can be known at this time will produce a certain amount of lift in the fins, but the direction of the lift of the two sides of the fins is diametrically opposed, then the two will carry out the relative transverse rocking, which formed a stable control moment, this is the operation of the rocking fins, it is obvious that the very efficient! Science, in my opinion, is the main reason

why this invention is so popular in today's marine engineering, as it converts harmful winds into favorable winds.

Of course, the control system of the fins is also essential, because the fin angle and the lift generated by the fins are generated by the control system, the control system is good or bad to a certain extent also determines the effect of the fins. Therefore, the external and internal parts of the fins are closely connected and are indispensable, and they complement each other to form a set of reasonable functions as a whole of the fins.

2.2 Modeling of ship's transverse rocking motion

The ship's moment of inertia, resistance moment and recovery moment and the disturbing force of the waves are not what we think of as mutually exclusive, but are balanced and coordinated with each other. They promote each other's operation, it can be said that without any one of them the other is bound to operate. Here we need to introduce a similar physical quantity: the damping coefficient of the boat's transverse rocking, which is similar to the coefficient of spring strength in physics, the strength coefficient is related to the material of the spring itself. The coefficient of stiffness is related to the material of the spring itself, while the damping coefficient of transverse rocking is related to many factors, such as the shape of the hull, the frequency of transverse rocking, the amplitude of transverse rocking, the loading of the ship, and even the viscosity of the water. Therefore, the production of the ship's transverse rocking motion model in the ship to carry out normal transverse rocking motion is inevitably important, it is as the basis of this movement, we researchers must not be negligent, so we ship engineering in practice usually use theoretical modeling and measurement of the actual ship combined method, only in this way can we maximize the performance of the design to ensure that the requirements of the performance.

2.3 Angular velocity gyro and amplifier

In the ship's transverse rocking control system, there are also a series of instruments that can carry out precise calculations, the most typical is the angular velocity gyroscope, which is used as a measuring instrument to measure the propagation of the transverse rocking angular velocity, but also in the form of an efficient and intelligent voltage signal output. Then there is the amplifier, not in the ordinary sense of amplifying something, but amplifying the transverse angular velocity signal output from the angular velocity gyroscope to drive the next level of controller. Of course, the amplification is not set in stone, but changes with it depending on the control system.

3. Ship Power Positioning System

The ship dynamic positioning system was developed in the mid-twentieth century.Nowadays, the economic trend is not optimistic, and one of the main problems arising from the loss of energy and resources, the natural environment of the resources let people feel the importance of incomparable. But the resources of the sea is not very easy to obtain, if not today's advanced technology and technical capabilities, people may be on the development of marine resources, even less than ten percent, so now for many marine

operations ship, the power positioning system has become an indispensable support system in the marine engineering.

Power positioning system is not as simple as the name sounds, it relies on its own detection system to detect the deviation of the ship's actual position from the target position, and then accurately calculates the disturbing force brought about by the wind and waves and other external factors, so as to enable the thrusters to produce the corresponding thrust, so as to enable the ship to travel in the direction of its own target. This method is obviously easy to operate and quick to move, and is an indispensable positioning system for powering today's ships.

Such high-tech technology emerged in the 1960s and 1970s, and many parts of the world are using this positioning system. The first ship with a power positioning concept was the Eureka, designed and built in 1961. This ship also featured many tight parts, such as being equipped with multiple controllable thrusters. With the continuous development of power positioning systems, there are now more than 2,000 vessels with this capability worldwide. These vessels are of various types and are utilized in different technical areas of the maritime industry, which shows the wide range of applications and the effectiveness of this technology. Many of these areas include rock drilling, diving support, pipe laying, dredging and sand mining, etc. The reason for the use of power positioning systems in these areas is partly due to the fact that most of these areas need to be carried out in harsh environments and it is best to remain environmentally conscious, which is a factor that has contributed to the continued development of the power positioning system.

But strive for excellence is the spirit of China's ship navigation business needs to be maintained, many universities and research institutes have carried out research on the power positioning system technology, they explore each other's research, mainly focused on the more difficult aspects of the power positioning system, such as neural networks, genetic algorithms, etc., which will be used in the corresponding automation and physical science knowledge.

3.1 Working principle and components of power positioning control system

The basic principle of power positioning is to use the measurement system to detect the disturbing force of the wind and waves, transmitted to the system for signal analysis, reflected to the electronic computer and then analyzed again, so that the output command can be started, so that it sends out the corresponding thrust to promote the operation of the ship, and ultimately return to the state of static equilibrium with the disturbing force of the environment, that is, to make the ship return to its original set position and direction.

Ship positioning system usually consists of three parts: measurement system, control system and thruster system. The core part is the control system composed of computers. The role of the thruster is particularly important. Physical quantities such as rotational speed, direction angle, rudder angle, and pitch are decomposed and solved by the torque command from the controller. Secondly, the feed-forward control algorithm is also an important calculation method, which is the basic feedback method for controlling position and bow deviation.

The internal structure of the power positioning system is not without rules and regulations, and it can usually be divided into seven parts, which are the computer, the control console, the position reference system, the bow sensor, the environmental measurement system, the propulsion system and the power system. These seven systems are indispensable, each has its own function and is interconnected with each other. Next I will introduce these seven parts with different purposes.

3.2 Components of the power positioning control system

(1) calculators

A computer used in a power positioning control system is, by definition, called a power positioning computer. However, this computer is different from a traditional computer in that the number of computers, the method of operation, and the level of redundancy of the power system on board the ship are of primary importance to the operator. This computer is primarily responsible for the power positioning function, but not for traditional uses such as calculations. The role of the computer can also be to issue two position commands so that the average of the error is reduced to zero, and there are some who question how this is possible, but in fact it is, and the reliability of many high-tech technologies is indeed very high, and very much in tune with this type of engineering on ships.

Of course, the ability of such computers are not allowed to be too low, because the main function of the power positioning system controller is very much, receiving instructions, analyzing instructions, running instructions and many other steps, which need to be completed once or twice per second, is very fast, this time often need a computer with high-speed computing capabilities to complete the task, otherwise the controller will produce internal disorder.

(2) consoles

I believe we all have more understanding of the role of the ship's console, it can be called a search of the ship's core, because we need to use the console to control the ship, and even send and receive data, can be called the ship's different parts of the operation of the “link”, but also an essential part of the. It is also an essential part of the ship. It is responsible for all the control inputs, switches, indicators and even alarms that are placed on it. The console is not confined to the bow bridge, but for most vessels (including most offshore supply vessels) the console is located in the stern bridge, i.e. towards the stern. Then there will be another part of the ship's controller is located in the bow, whether it is the stern or the bow, as long as it is not in the impermeable compartments, the console will be able to better play his proper role.

(3) Environmental measurement systems

Typical environmental measurement systems include current meters, wind sensors and so on, all kinds of environmental measurements can help ships to position themselves so as to maintain better navigation. The current meter can provide some front-end information for the positioning system, but the disadvantage is that the cost is high, so our ships are not used very often, but when there is a higher requirement for a certain ship, this technology can be used. Next to explain the wind sensor, the wind sensor is used to measure the wind speed and

direction of the wind, so as to better control and calculate the front-end instructions sent out, and the current meter associated with each other to help each other, the wind feed-forward can be generated through another sense of the wind thrust to compensate for the detected wind brought about by the perturbation, which is undoubtedly a very advantageous edge of the ship traveling in the wind, not only reduces the ship in the high winds produce It not only reduces the loss of energy and material in high winds, but also provides a corresponding guarantee for the safety of the ship in bad weather to a great extent.

(4) Position reference system

Position reference systems have a certain rate or even accuracy to provide effective and accurate information for the controller's calculations so that the ship can accomplish its intended tasks. Different position reference systems are used for different purposes.

①DGPS: This system consists of a space satellite system, a ground monitoring system and a user reception system, which can accurately provide positioning and navigation information, and is more frequently used in a wider range of applications in the world.

②Acoustic system: The principle of operation of the acoustic system can be referred to the physics of sound waves, it will be a group of transmitters or receivers in a certain geometric shape so that the formation of a base array on board, but also on the seabed in the corresponding coordinates. In turn, systems applied to acoustic signals, such as short and long baseline systems, are borrowed to propagate the information received in the transmitters through the water to the receivers. The system then calculates the position of the ship based on the general location of the signal. The only disadvantage of this system is that there is sometimes some transient or short-term interference.

③Tensioning cable: Tensioning cable is connected between the hull and the seabed, used to measure the ship in the case of constant tension tilt, and through a more intelligent method, that is, according to the hull of the steel cables and the seabed of the three major components of the geometric figure to determine the position of the ship sitting, how vivid and clever principle of work!

Automation technology used in the ship can be said to be blossoming, showing the charm of each other different color.The only disadvantage of this system is that the prolonged presence of water currents may cause the tensioning ropes to shift over long periods of time, and the accuracy is not as good as that of the acoustic system.

To summarize, the three positional reference systems play different roles according to their own purposes, and so do our ships, “teaching according to the material”, combining the need to apply different systems, and even combine them to work together.

4. Shipboard Jetlink mine-hunting sonar stabilization system

The Thunder Sonar Stabilization System was developed in the mid-twentieth century.Protect the security of our marine territory can not be delayed, maritime security is not only related to this country's huge interests and even involves the interests of our territorial part of the absence of maritime security, there is no national security. Insist on promoting our country's maritime engineering is a certain guarantee of maritime security, another point of view, our country's vast sea area, can be said to care about the protection of

the wider region, so our country in the advancement of mine-hunting system still has a lot of room for progress.

Mine hunting sonar stabilization control system also includes many, such as mine and mine hunting sonar.

First of all, let's look at the mine, mine is a kind of good concealment of the “water weapon”, since ancient times have been widely used in war. It can be used as a weapon to defend their territory, but also as a weapon to attack the enemy. According to its position in the ocean can be divided into three kinds of mines, respectively, floating mines, anchor mines and submerged mines. The characteristic of mines is that they are small and cannot be easily detected when they are sunk on the bottom of the sea. Therefore, mines are a wide range of marine weapons that are worthy of being used.

Then there is the sonar, I believe we have heard of sonar, “like a bat to send outsound waves used to detect and locate” instrument, minehunting sonar is each country's naval forces after a long period of exploration to find a very effective means of anti-personnel mines. The main purpose of using minehunting sonar is very simple, it is to search, identify and locate the mines, and eventually destroy them. Sonar science and technology is also widely used in China's maritime engineering business, but also for the safety of our navigation to find the danger of eliminating the danger of the necessary protection. Here I mainly introduce the Jetlink mine-hunting sonar, the control system of which has two main functions: on the one hand, it converts the effects of the three major motions of the isolation vessel, namely, longitudinal, transverse, and bow-rocking, into the effects on the attitude of the base array, so as to make the relative geodetic coordinates become more stable. On the other hand, it is to drive the base array to the expected position of the ship according to the control signals detected by other systems. In general, the main purpose of these two functions is to keep the attitude of the base array constant with respect to the geophysical coordinate system. Among them, play the most important purpose or hunting mine sonar in the three axes, respectively, a, β, and γ axis, the three axes coordinated, together cast a sonar inside the “digital platform”, this platform will give the sonar outside the computer to provide the appropriate signals into the computer these different signals will be sent into three circuits respectively Servo system in the digital signal processor DSP, DSP continue to signal processing, and ultimately through the digital-analog conversion, correction and amplification steps will be based on the array rotation to the required position, which is the working principle of the sonar internal digital platform.

In summary, even if the sonar is used to explore the need to use to high-tech technology and even automation related logic theory knowledge, automation and sonar, and every part of the ship are closely related, the two can only be mutually beneficial and win-win relationship. Our country is also in the integrated automation and other technologies together for the cause of marine engineering to add a more brilliant luster.

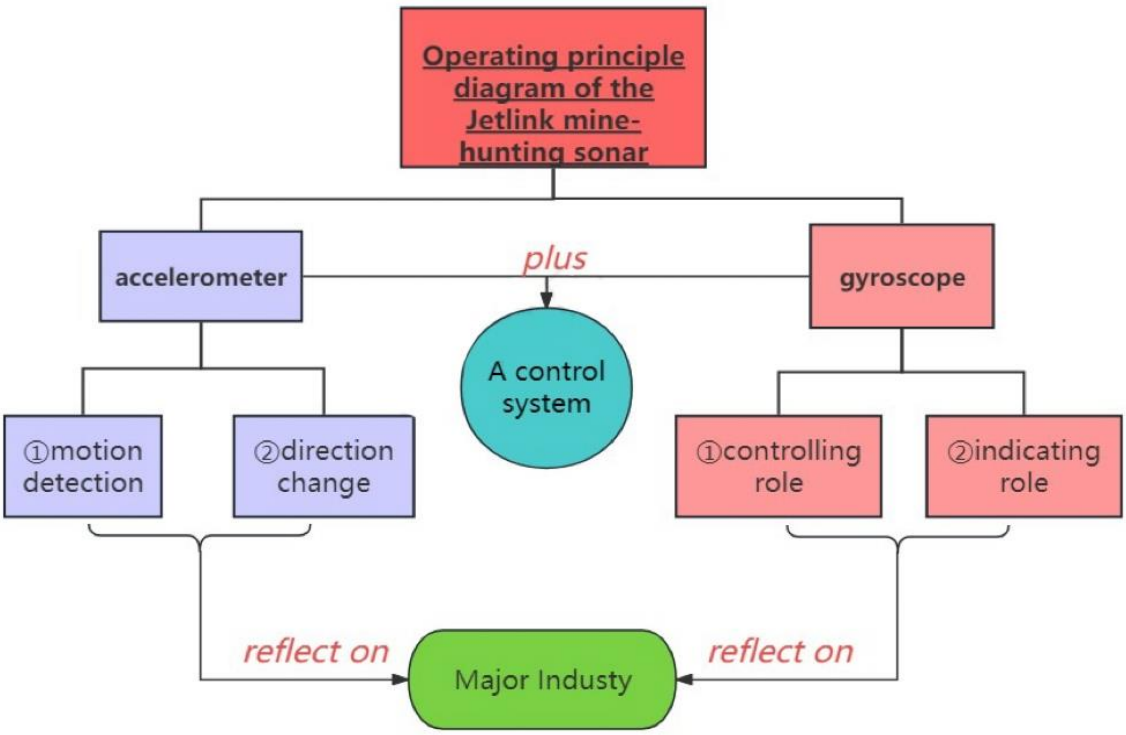

Figure 2: A schematic diagram of the workings of the Jetlink mine-hunting sonar

It is useful to help students read more visually and clearly how the Jetlink sonar actually works in detail.

5. Vessel heading - rudder/wing rudder control system

The ship heading-rudder/wing rudder control system was developed between the mid-to-late twentieth century and the twenty-first century.To ensure the perfect heading control, it is necessary to transform the forward thrust of the ship into the transverse force of the ship's rotation as much as possible, the greater the ratio of transverse force to thrust, the greater the rudder torque generated, and the transverse force is also associated with other factors, namely, the wing arch, within a certain range and at the same angle to achieve the value of the lift with the increase of the arch increases, which is the source of the marine flap rudders. However, in the current engineering, there is still a part of the limitations, that is, the rudder and the wing rudder has a definite angle ratio between the rudder, some people think that this effect is insignificant, but this may not be able to give full play to the wing rudder efficiency and energy saving. However, it is possible to optimize the rudder's range of motion, so that when the range of motion is reduced, the energy consumption of the system will also be reduced. In this way, even if the ship is sailing in bad sea conditions, the coordinated motion of the rudder and wing rudder can strengthen the heading control ability of the automatic rudder system, thus achieving the purpose of sailing.

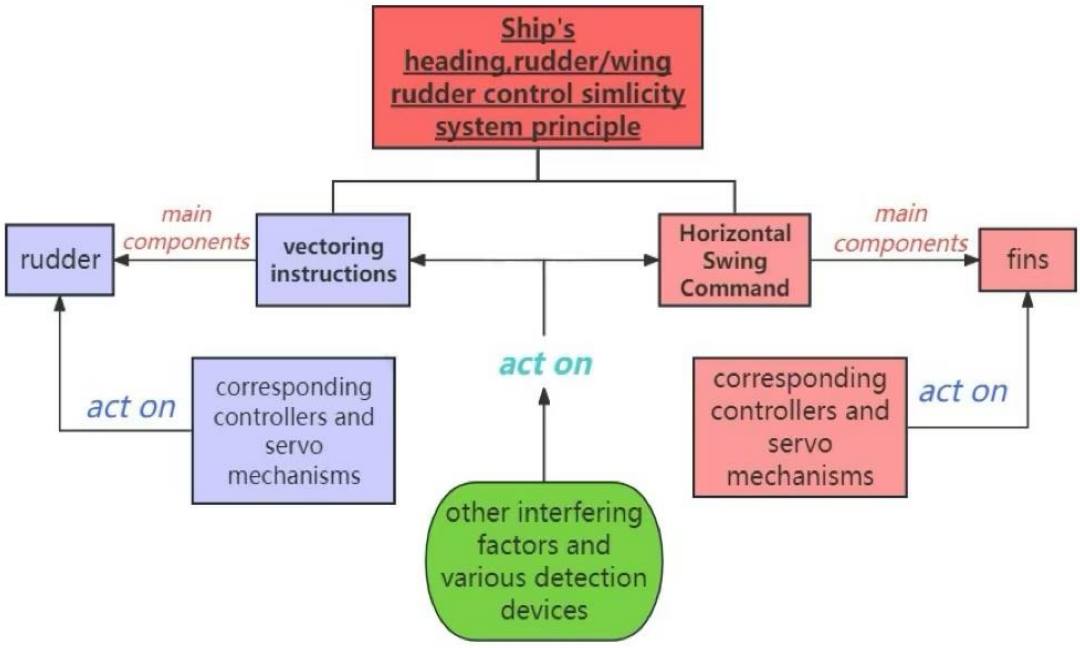

Figure3 :It is the structural diagram of the principle of ship heading-rudder/wing rudder control system

(A)From the figure, it can be simply obtained that the heading intelligent robust controller is composed of heading robust regulator, rudder angle/wing rudder angle intelligent decision maker.

(B)First of all, the regulator through the investigation of the detection device to get the heading angle deviation calculated control torque, rudder angle / wing rudder angle decision-making according to the value of the control torque to measure the rudder angle and wing rudder angle, it does sound a little complicated, but the actual internal cycle of the layer by layer progression of logic, and ultimately produce the control torque required by the ship's navigation, and then realize the control of the ship's heading.

(C)A series of domestic scientists have also conducted in-depth research and analysis of this, the most typical is the famous rudder/wing rudder hydrodynamic characteristics of the mathematical model established by Professor Liu Sheng and his team. Sampling and regression model parameters fitting to the survey data that have been obtained, so as to improve the mathematical model to be created. As the name suggests, the production of this model must be accompanied by the knowledge of mathematical theories, such as the use of genetic algorithms, which also provide a solid and reliable cornerstone for this mathematical model.

(D)Combined with the efforts of many research studies, the Chinese rudder/wing rudder is now able to achieve good heading control and energy-saving effects, which is a source of great concern and pride, adding to the history of China's ship navigation.

5.1 Intelligent fault-tolerant control system for heading/tracking of large ships

It is not difficult to know, none of the sea factors are complex and variable, to put it in another way, the ship's trajectory control system is not omnipotent, there are errors in order to have progress. This error can be attributed to two major categories: the first is the first category: indirect track control through the heading adjustment, the formation of the control of the inner ring, the middle ring and even the outer ring combined with the nested form, can not be denied absolutely this program, there is only a low degree of refinement a shortcoming. Second is the second type of error: heading, trajectory integrated control mode, seems to be integrated control, in fact, is a combination of ship heading, trajectory controller function, directly realize the rudder angle to the trajectory of the control strength. The trajectory control accuracy of this program is improved compared to the previous one, but the coupling of the system will be enhanced, and the core problem is that the operation of this program is extremely difficult to debug and less flexible, which is also a fatal error that can not occur in the operation of the ship.

There are many aspects of ship operation that are worth noting, and normal operation programs require a certain degree of fault-tolerant systems, otherwise errors cannot be completely pointed out. Therefore, in order to ensure the basic navigational performance as well as the vitality and combat effectiveness of large ships, it is necessary to carry out research on fault-tolerant control in some parts of large ships. Don't look at the ship's control system failure and automobile failure is almost the same, in fact, the impact is more terrible, here because of the consideration of a number of aspects. First of all, the car on the road can get timely rescue, but the ship at sea, not to mention the way to get rescue will be more difficult, the manpower will also be seriously inadequate, and even reef, grounding and other dangers, so that the ship out of control of the consequences is unpredictable, alarming. This is the necessity of setting up a fault-tolerant control system in ships.

For example, in 2009, a French aircraft carrier “Charles de Gaulle” sound system in the rotating shaft failure, resulting in the ship in the following weeks or even months can not run, this background is okay, but in the combat era, the consequences are unimaginable.

In short, it is indispensable to have fault-tolerant systems in ship systems, and fault diagnosis and fault-tolerant control are often considered to be one of the key indicators of system reliability. In order to guarantee the safety, maneuverability and economy of ships at sea, only by setting up a good fault-tolerant system can we more effectively avoid the attack of enemy ships and improve the combat effectiveness of our ships, which is of great significance to us on the battlefield at any time. Thus, it can be seen that our country through the use of automation-related advanced technology, for the future of our country and national security to make corresponding preparations, which makes China's future has hope, have expectations!

5.2 The working principle of the Air Trail Intelligent Fault Tolerance System

The fault-tolerant system is mainly composed of intelligent diagnostic unit, control intelligent decision-making unit and fault-tolerant control unit and other heading controller parts. In fact, the working principle is not very complicated, mainly to collect the information of the ship's working state, and analyze, pre-processing is completed and then use a series of

artificial intelligence to run the diagnosis of fault information. The whole operation process is clear, this is the automation of the corresponding technology into the necessary steps of marine engineering. At the same time, also need a certain system to fault-tolerant system for intelligent coordination, which is mainly by the decision-making system to complete, but this decision-making is by no means a step, but step by step, so as to complete their own system ideal optimal program.

5.3 Fault-tolerant control systems are constantly optimized for development

Through the continuous optimization of the fault-tolerant system, the idea of distributed fault tolerance is proposed, which is undoubtedly the optimization of the fault-tolerant system to improve, so that down the fault-tolerant control system can be more efficient solution to the synthesis and implementation of the problem, in order to achieve a more accurate control effect. In order to control the sensor or actuator and other trajectory system settings, generally speaking, will be used to the relevant mathematical knowledge, and at the same time to establish mathematical models, which helps to help researchers to understand and run the controller, so as to control the so-called ship in place, thus significantly improving the reliability of the entire control system, which is undoubtedly a major feat of theoretical significance for China's marine engineering and the value of engineering applications. This is undoubtedly a great feat for China's marine engineering with theoretical significance and engineering application value, and it has become the most basic condition for the control of fault-tolerant system.

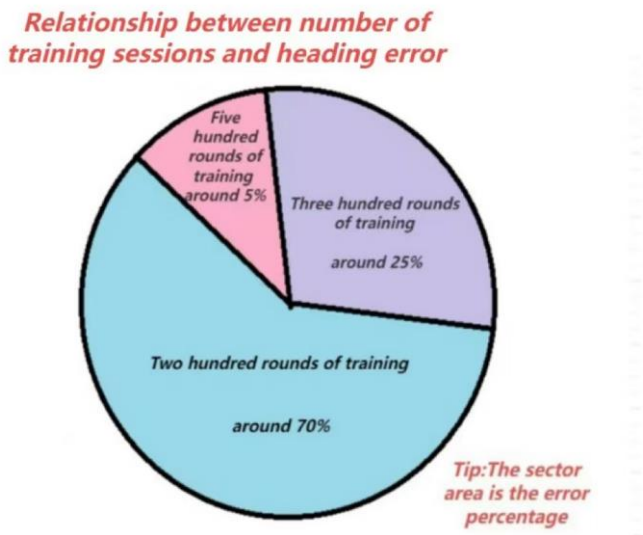

Figure 4: A fan chart of the number of training sessions versus heading error for the fault tolerant system

It is easy to learn from the graph of information is the higher the number of times of training, the more frequent the use of the fault tolerance system, the ship runs the smaller the heading error, the more accurate and correct heading, on behalf of the graph we can

intuitively feel for the use of the ship's heading trajectory intelligent fault-tolerant system of the necessity of the ship.

6. Controllers

Intelligent controllers were developed in the 21st century.Controller design is divided into many kinds, the most typical is the PID controller and the most emerging intelligent controller, to protect the ship in the navigation safety, the first thing is to make the ship to get the balance, in the face of wind and wave attack, the ship on the different positions of the control force is also different, at this time it is necessary to make a controller to make the maintenance of the balance, the wind speed is known to contain a variety of different influencing factors, all known The controller is actually a linear combination of transverse rocking angle, transverse rocking angular velocity, and even transverse rocking angular acceleration, so we should also take these different factors into consideration while making the controller, so that we can maximize the rocking reduction device to achieve the best rocking reduction state.

There are many things have this or that uncertainty, such as the ship's loading problems, different ships have different weight, and the marine environment is not static, or weather or human factors, there may be a gradual change in the marine environment to produce a subtle change, either good or bad. Such influences, it is possible to make the design of the PID controller parameters can not play out the maximum level.

For this serious problem, scientists have also explored the research and give the corresponding solution, of course, which is not without the help of intelligent technology, this time the intelligent controller will be on the field, its adaptive capacity is exceptionally strong, can adapt to the complexity of different objects and uncertainty, so as to flexibly combine the three major control in the ship (shaking fin fuzzy control, adaptive control and neural network control) to Enhance the flexibility and variability of the control system to get a better rocking reduction effect. To summarize, if we want to have a safe and good ship navigation, it is necessary to have a controller and intelligent controller.

6.1 Speed regulator and wave level sensitivity regulator

As the name suggests, “regulation” is to make the operation of an object more balanced and stable, and this is the role of the speed regulator and the wave sensitivity regulator here. The stability of a ship is affected by many factors, and the influence of the liquid flow rate on the surface of the ship is the most enormous, which triggers an increase in the torque and the open-loop gain, and then the stability decreases, and then the ship will face the danger of capsizing, which is a result that any mariner would not like to see. At this time, the ship will face the danger of capsizing, which is the result that no one is willing to see, the flexible use of these two regulators, so that they and the operation of the ship to coordinate with each other, so as to safeguard the safety of the ship, is a great feat of marine engineering operation of the ship, it can only be said that the ship even if each part is small, but all play an important role, can be said to be a ship's It can be said that every part of the ship plays an important role even if it is small, and it can be called the “eye-catching pen” of the ship.

6.2 Fin Servo

The operation of all ships is not always aimless, some ships will be used to transmit tracking control signals, so as to obtain the relevant information they want to get, this time we need to use our fin servo system, which is used to receive a variety of signals from different controllers, will complete the signal power amplification, and drive the indicator fins in accordance with the received signals required to carry out a movement. This procedure is similar to that of a robot, where a human gives it signals and instructions and it carries out the task according to those instructions. This is how a fin servo system works, and it is clear that artificial intelligence is involved in all aspects of things, and this is an extremely vivid example of artificial intelligence in ships. Professionally speaking, this link can be represented by a proportional link, Ka, which is a physical quantity that can be expressed either statically or dynamically, and which can be combined to maximize the satisfaction of the ship control system.

6.3 Vessel heading control system

As mentioned above, the ship's operation is not aimless, generally speaking, the ship's operation is to hold a purpose, they have a course and route, then how to ensure that it is traveling on the correct course, and how to know that their own ideas are correct? This time we need to use our ship heading control system, the fundamental purpose of this system is to pursue the safety and economy of the ship, so as to provide a more accurate heading and track to complete the voyage. Of course, the ship also has a good and poor points, there are some ship control system is relatively poor compared to others, this is unchangeable, this time the need for heading control system to provide the appropriate help, the use of course a lot, for example, it can correct the ship's heading deviation, thus reducing the ship's mechanical power consumption, the reduction of the magnitude of the magnitude of the more and less, this is not saving energy to achieve a kind of green realm? Green realm?

Usually on ships such as dragon boats have a certain understanding of the people must know that the ship's heading control is realized by manipulating the rudder movement. Undoubtedly, there are different types of rudder, one is the automatic rudder, the other is the overall rudder, the former is mostly used in the early rudder structure is simple but the control surface of the ship, while the latter is mostly applied to large ships. Automatic rudder products have been in use since the 1980s, they rely on adaptive rudder to rudder technology advantage to occupy the mainstream market of the trajectory, to this day are widely used in certain areas. On the contrary, the integrated room track automatic rudder is not as high as the former degree of use, the product is also relatively up less, but often not bad, because it adopts the optimal control of high-tech multi-variable technology. It can be seen that different ships still need to choose its appropriate rudder, rather than blindly with the public, so as to better protect the ship's precise control of the track.

In the 1970s, China made a lot of outstanding achievements in the development and research of rudder, some domestic rudder research clinics have achieved a lot of success, such as the China State Shipbuilding Corporation Ship Systems Engineering Department and

a part of China's colleges and universities, for the rudder research and development of the rudder to dedicate a lot of contributions to the publication of a large number of rudder with professional knowledge and its solution to the paper, which is undoubtedly for the development of rudder in the ship is worth remembering a milestone. This is undoubtedly a milestone to be remembered in the development of rudders in ships. But our country for rudder development level is still not as good as foreign countries, but our country maintains the pace of progress, and constantly learn from and learn from, take the essence of the bad, so that the immature products are maturing day by day. But our ship on the rudder has a big feature: that is, a track control module, it can be navigation and positioning and track keeping, heading control into one, this way no artificial can also ensure that the ship automatically along the target of the planned route sailing, which is a major breakthrough in China's maritime career.

It can be seen that any part of the ship is not as important as heading control, because heading control is the most basic. No matter when and where, no matter what kind of ship, in order to complete a variety of tasks must be accurate heading control, in order to maximize the success of the letter of the voyage to ensure.

Next let me explain the working principle of the ship rudder, when the ship's heading is consistent with the commanded heading, the heading deviation is zero, so the heading controller outputs a zero rudder angle command signal, the rudder makes the rudder return to the zero position, and the ship stays sailing on the commanded heading. Therefore, in the face of waves, sea winds and other disturbances make the direction deviation, the heading control system will start to play a role in bringing the ship back to the commanded heading.

7.Conclusion

First of all, the overall content of this paper is mainly a series of automation science and technology applied to ship engineering, as well as my shortcomings of this project and future prospects. In a word, I think innovation is something that should not be delayed, not only the innovation of talents and programs, but also the innovation of technology. We should keep examining different types of technologies, researching more in-depth technologies and even trying to apply and combine them, so as to maximize the advantages of automation and add different colors to the shipbuilding business.

Secondly, the theoretical analysis of the above article I applied to the study of the value of automation technology for ship engineering, first to the simplest efficiency issues, automation technology can effectively optimize a series of cumbersome steps in the ship engineering, so as to achieve the effect of saving time to maximize efficiency, which is undoubtedly a necessity for the development of today's times. And then look to the energy and environmental needs of the problem, today's society is bound to belong to the state of energy scarcity, the environment is also each of us need to protect the heart of the earth, automation technology can provide corresponding protection for both, for example, can reduce the role of fuel emissions, and so on, so it can be seen that the automation technology is of great significance. Finally, we can look forward to the most far-reaching problem, that is, the ambitious goal of the sustainable development of marine engineering. The trend of the

times is undoubtedly intelligent technology, ship engineering is also the same, automation technology is not only the basis of intelligent, but also to promote all walks of life to intelligent necessary magic weapon. Therefore, for the above article I all involved in the application of marine engineering technology is very practical significance, only to be utilized in order to make the deep development of marine engineering.

Finally, and then briefly analyze the limitations of the existing research on automation technology, it is clear that most of the automation technology is generally more complex and changeable, in the face of the same complex and changeable marine environment, the unknown factors must be endless and even unpredictable. At the same time the technology and the environment is not 100% adaptable, automation technology has an indestructible side, then there will be a fragile side, if the automation-related technology has a certain failure, it will certainly produce the corresponding chain reaction, leading to program disorders, and even lead to the crisis of the sea voyage. Combined with the reality of the factors, China is now vigorously developing the economy and talent, the existing situation is more demand than supply. And automation technology has the complexity, and the need to invest a lot of money, both of which will certainly be on the status quo of Chinese society nowadays to cause some pressure. So all in all, the existence of automation technology has advantages and disadvantages, we should weigh the two and reasonably analyze the application, in order to make it go farther.

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