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Cable System in Marine Engineering Based on Agglutination Parameter Analysis Method

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Abstract: Due to the huge number of cables in marine engineering, the quality of cables is difficult to be guaranteed, and the resulting cable quality problems occur from time to time. Therefore, in order to control the quality of cables in marine engineering, the cable system must be all links are regulated. In order to solve the shortcomings of the existing research on cable systems in marine engineering, this paper discusses the analysis curve algorithm function equation of agglutination parameters and the cable design rules in marine engineering. The development tools and hardware settings of the medium cable system are briefly introduced. And the design and discussion of the cable system architecture in marine engineering based on the agglutination parameter analysis method, and finally the experimental analysis of the accuracy of the parameter value of the cable system in the cable curve modification based on the agglutination parameter analysis method in the marine engineering. The experimental data It is shown that the accuracy rate of the agglutination parameter analysis method in the parameter value test of cable curve modification is in the range of 0.91 and 0.98, and the accuracy rate of the parameter value of cable curve stretching, rotation and array modification is the highest. 0.98 and 0.97, thus verifying the effective value of the agglutination parameter analysis method in the cable system in marine engineering.

1. Introduction

With the development of mechatronics technology and the enhancement of people's demand for electronic products, under the urgent requirements of the development of marine engineering, the application of cables will be more extensive, aiming at the rapid assembly requirements of marine engineering for equipment and cable system assembly.

Nowadays, more and more scholars pay attention to the research of various technologies and platforms in the cable system in marine engineering, and through practical research, they have also achieved certain research results. In order to solve various problems existing in the cable system in engineering, Stefanovic V P proposed a new type of cable with different functions, mainly including the length and size of the fixed CFR cable bundle. The results show that the electrical performance of the new cable is mainly determined by the weight and properties of the CFR cable bundle, so the material properties of the new cable can be fully utilized. By optimizing the properties of the cable, it is shown through experiments that the power efficiency of the proposed new CFRP cable bundle can reach 90% [1]. Altnay L In the resulting cable system, the constituent cables are divided into shorter segments by means of cross-connections, thereby significantly reducing their effective length. While bending stiffness plays an important role in the behavior of shorter cables, its effect is not accounted for in any existing cable system analysis models. In order to evaluate the effect of cable bending stiffness on the in-plane dynamic response of the cable system, Altnay L refined the existing two-cable network analysis model by considering the cable bending stiffness in the formula. A set of closed-form solutions are derived to clearly reveal the effect of cable bending stiffness on the modal response of two cable systems with different configurations. It is found that cable bending stiffness affects the wire by increasing its modal frequency. All modes of the cable system, in which the stiffness effect on higher-order global and local modes is more pronounced [2]. Alzamora AM proposes that high-temperature superconducting cables have become one of the most promising technologies, while employing a unique superconducting conductor that can transmit large amounts of electronic power over long distances with less power loss. The diagnosis and monitoring technology for the reliable and safe operation of HTS cable systems has also become a key factor for the commercialization of HTS cable systems in related fields. HTS cable systems that require a cooling process to reactivate superconductors are more affected by cost and time loss. In this paper, a diagnostic technology of live cable system based on time-frequency domain reflectometry is proposed. By employing inductive couplers, live cable systems and diagnostic signals, communication is possible without direct contact. Signal attenuation and distortion during signal induction are compensated for by the neural network based on. The proposed method is applied in an AC cable system and further verified by advanced design system software [3]. Although the existing research on the cable system in marine engineering is very rich, the research on the cable system in marine engineering based on the agglutination parameter analysis method is still insufficient.

Therefore, in order to solve the existing problems in the research of cable systems in marine engineering based on the analysis method of agglutination parameters, this paper firstly introduces the steps of the curve algorithm function equation of agglutination parameter analysis and the design rules of cables in marine engineering. The development tools and hardware settings of the cable system based on the analysis method in the ocean engineering, and finally designed the cable system architecture based on the agglutination parameter analysis method in the ocean engineering, and through the application of the cable system in the ocean engineering based on the agglutination parameter analysis method Experiments are carried out, and the final experiment shows the feasibility of the cable system in marine engineering based on the agglutination parameter analysis method proposed in this paper.

2. Research on Cable System in Marine Engineering Based on Agglutination Parameter Analysis

2.1. Agglutination Parameter Analysis Curve Algorithm

The key step of applying the parametric analysis curve method to the configuration of offshore engineering cables is to determine the stretching, rotation and array curves of the offshore engineering cables, so the key problem in establishing the mathematical model of the agglutination parameters of the offshore engineering cables is to use an appropriate agglutination parameter analysis function to describe the stretch, rotation, and pattern curves of cables. In the cable curve design of the agglutination parameter analysis curve method, the cable curve mostly adopts a special vector function form [4]. As shown in formula (1):

$$g(k)=\sum_{v=0}^{u} t_v \varpi_v(k) \tag{1}$$

Among them, $\varpi_v(k)(v=0,1...,x)$ is called agglutination function, which determines the overall state of cable stretching, rotation and array curve; $t_v(v-0,1...,x)$ is called coefficient vector. Through different definitions of agglutination function, the main parameter analysis curve method has A-like cable curve [5].

Given the cable curve modification point $G_u(u=0,1,...x,...x+y)$, the mathematical expression (2) of the c-time A-like cable curve is as follows:

$$g_{v,x}(k)=\sum G_{v+u}\cdot H_{u,\ x}(k), k\in[0,1]v=0,1,...y \tag{2}$$

Among them, $H_{u,x}(v)$ is the secondary x-spline basis function, also known as the A-spline piecewise mixing function [6]. Its expression is:

$$H_{u,x}(v)=\frac{1}{x}\sum_{a=0}^{x-u}(-1)^a\cdot D_{x+1}^a\cdot(v+x-u-a)^x, v\in[0,1], u=0,1,...,x \tag{3}$$

From the above formula (3), it can be seen that the $y+x+1$-like cable curve is modified in sections [7]. If A vertices $g_v(v=0,1,2,...,y+x)$ are given, the agglutination parameter cable curve of $y+1$ segment and x can be defined, and the v-th segment and x-degree A-like cable curve are at most related to $x+1$ vertices $g_a(a=v,v+1,...v+x-1)$, which is the local part of the A-like cable curve properties [8].

2.2. Cable Design Rules in Offshore Engineering

Cable routing is not simply to "connect" two electrical components together in the simplest and most convenient way, they must follow the relevant rules [9].

(1) The direction of cables in marine engineering must consider heat dissipation, anti-vibration, reasonable direction and as short as possible to reduce capacitive and inductive coupling [10].

(2) In marine engineering, power cables and signal cables should be avoided to be arranged in the same wiring trough and too close to each other, and span vertically [11].

(3) Cables and shielded cables in the same direction should be set according to the cable bundle [12].

(4) When the cables must be crossed, the ground power coupling should be avoided [13].

3. Investigation and Research of Cable System in Marine Engineering Based on Agglutination Parameter Analysis Method

3.1. Cable System DevelopmentTool in Marine Engineering Based on Agglutination ParameterAnalysis Method

Based on the agglutination parameter analysis method, the cable system in offshore engineering needs to use the database to store the electrical component information, cable information and assembly process file data information of the product, which can realize the remote query function [14]. Therefore, the design of the development tools for cable systems in marine engineering in this paper is shown in Table 1:

Table 1. System development platforms

Operating system	WindowsXP
Operating platform	Pro/ENGINEERWildfire2.0
Development environment	VisualC++6.0
Support software	Pro/TOOLKIT
	Pro/DEVELOP:Pro/TOOLKIT
	MFC dialog
	DO components
	Microsoft Excel2003
Database	Oracle10.0

3.2. Hardware Setting of Cable System in Marine Engineering Based on Agglutination Parameter Analysis Method

In order to adapt to the working characteristics of the chip, we adopted the FPG of EP1C6Q24 of CYCL of ALTE as the main controller of the system [15]. It has 4590 LEs, 6257 bytes of on-chip RAM, 10 clock phase-locked links and 150 cable-controllable I/O interfaces [16]. The internal current of EP1C6Q240C8 is 1.5v, and the external current is 3.6v. The high and low levels of the MSE and MS0 cables are set by the FPG chip, and different configuration circuits can be selected [17]. Table 2 shows the relationship between cable level and configuration circuit [18].

Table 2. MSE and MS0 cable circuits

MSE	MS0	Cable configuration
0	0	Active Serial Circuit
0	1	passive serial circuit
0	0or1	Based on JTAG circuit

4. Application Research of Cable System in Marine Engineering Based on Agglutination Parameter Analysis Method

4.1. Architecture Design of Cable System in Marine Engineering Based on Agglutination Parameter Analysis Method

Through the analysis of the specifications and requirements of the cable system in offshore engineering, the architecture of the cable system in offshore engineering based on agglutination parameter analysis method is constructed, as shown in Figure 1:

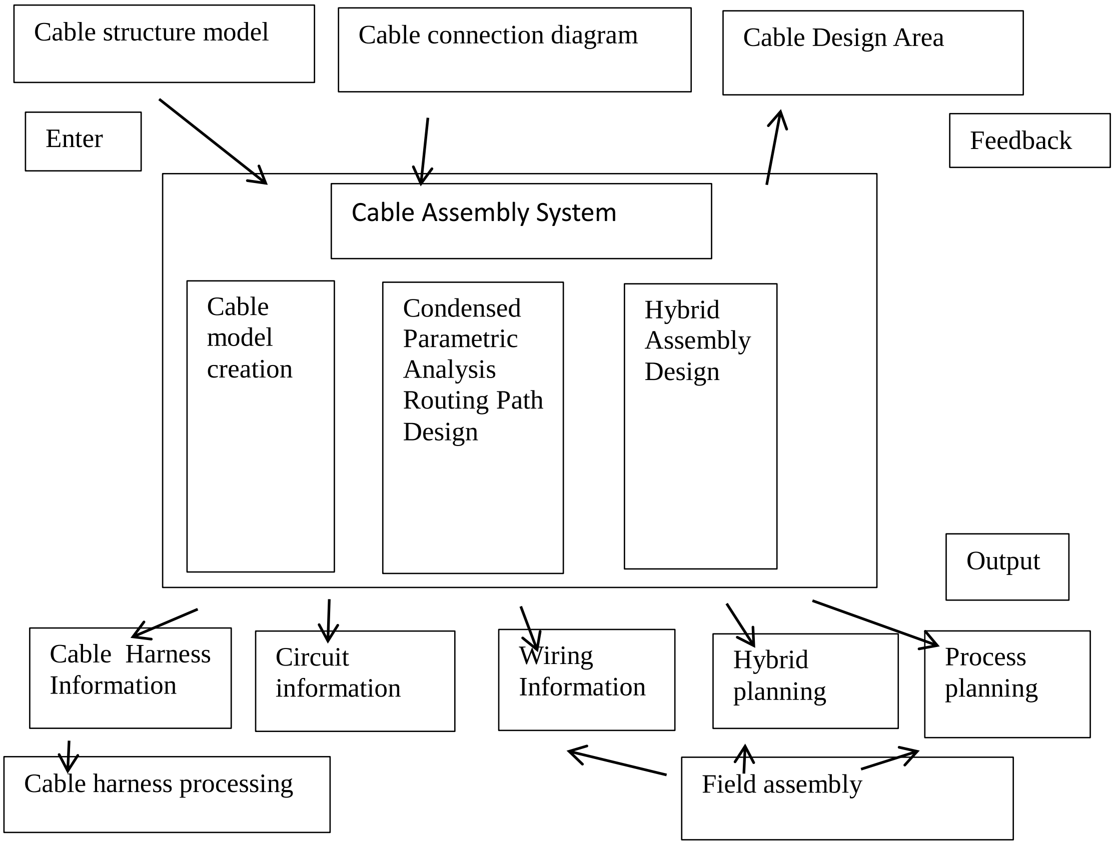

Figure 1. Cable system assembly structure

The specific cable system assembly structure in marine engineering has the following points:

(1) The cable structure model and the cable connection diagram are used as input, and the cable model is established. Through the cable routing path planning and hybrid assembly planning of the agglomeration parameter inspection, the optimized cable system in the marine engineering is obtained.

(2) Calculate and output the cable information through agglomeration parameters, as the basis for the processing and manufacturing of offshore engineering cable bundles.

(3) The production output of the animation of the hybrid planning process and the output of the cable assembly process planning with cohesion parameters can be used for the field assembly demonstration of the cable. The functional modules of the offshore engineering cable assembly planning system include five functional modules, including offshore engineering cable model, offshore engineering cable routing path design, hybrid assembly design, circuit query, and file output.

4.2. Application of Cable System in Marine Engineering Based on Agglutination Parameter Analysis Method

In order to verify the validity of the agglutination parameter analysis method proposed in this paper, the modified cable curve provided by the three aspects of stretching, rotation and array of the cable curve in the cable system in marine engineering is carried out in this paper based on the agglutination parameter analysis method. The accuracy of parameter values is tested, and the results are shown in Table 3 and Figure 2:

Table 3. Modifying the cable curve parameter value accuracy data

Cable Curve Status	Stretch	Rotate	Array
Parameter1	0.94	0.98	0.93
Parameter2	0.91	0.97	0.96
Parameter3	0.95	0.93	0.94
Parameter4	0.98	0.96	0.97

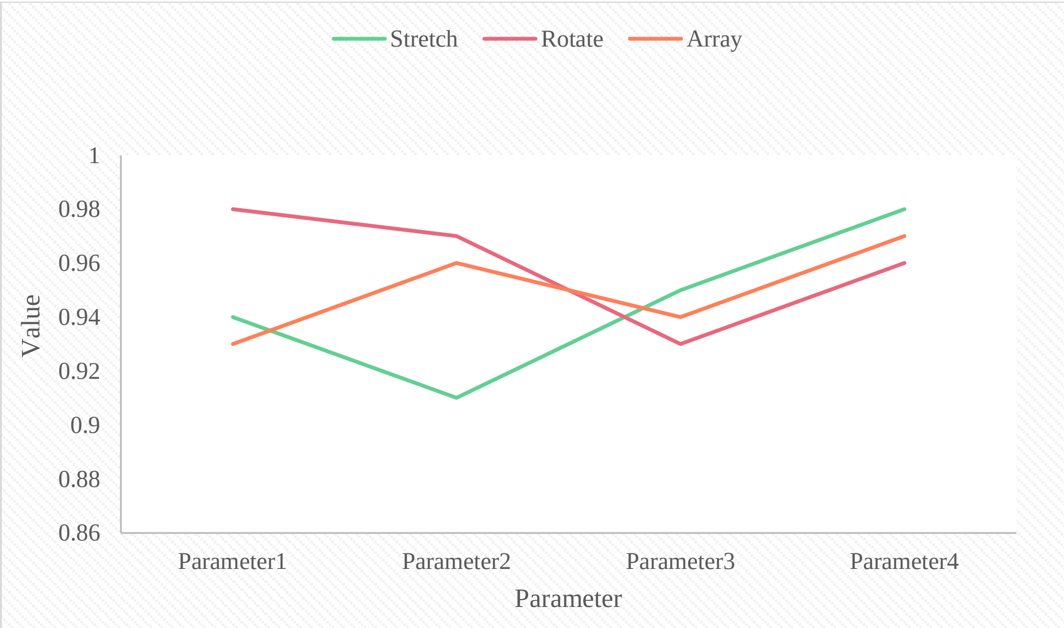

Figure 2. Accuracy trend of cable curve modification parameter values

Through the four agglutination parameters to analyze the accuracy of cable modification provided by the three aspects of cable system stretching, rotation and array in marine engineering, it is concluded that the agglutination parameter analysis method in Table 3 and Figure 2 above is suitable for marine engineering. In the cable system in the cable system, the three aspects of cable curve stretching, rotation and array modification provide the accuracy data and trend chart of the cable parameter values. It can be seen from the experimental data that in the offshore engineering cable system The parameter value accuracy rate provided by the curve modification in the method is relatively high, and the accuracy rate provided by the parameter values in the three aspects of cable stretching, rotation and array has reached more than 0.90. The modified parameter values provide an accuracy rate as high as 0.98, thus verifying the validity of the agglutination parameter analysis method in the cable system in marine engineering.

5. Conclusion

Therefore, in order to enrich the research on the cable system in marine engineering based on the agglutination parameter analysis method, this paper first briefly introduces the curve algorithm function equation of the agglutination parameter analysis method and the cable design rules in marine engineering, and then discusses the analysis method based on the agglutination parameter analysis method in the marine engineering. Based on the analysis and discussion of cable system technology in ocean engineering, the development tools and hardware settings of cable system in ocean engineering based on agglutination parameter analysis method are investigated and designed. Secondly, the design and analysis of the cable system architecture based on the agglutination parameter analysis method in marine engineering is carried out. Finally, the experimental data analysis is carried out for the application of the cable system in marine engineering based on the agglutination parameter analysis method. The final experimental results verify this paper. Feasibility of cable system in marine engineering based on agglutination parameter analysis method.

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Data Availability

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

Conflict of Interest

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

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