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A formal Analysis method of C language Real-Time system Operation based on TMSVL

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Abstract. The formal method requires a certain mathematical foundation, and the formal method can accurately standardize and verify the software system, which greatly improves the security and reliability of the software. This paper further analyzes the basic things of C language. We also learn to analyze the known and unknown topics, learn to consider problems together, and gradually expand our thinking. In particular, when confronted with major problems, the breakdown into many small problems to solve. This paper presents a formal Analysis method of C language Real-Time system Operation based on TMSVL.

1. Introduction

In recent years, with the continuous improvement of the hardware performance of embedded system, the scale and complexity of software in embedded system is also increasing, and the influence of software on the whole system has gradually occupied the dominant position. So the embedded software design and reliability guarantee become more and more difficult. The traditional embedded software design method has been gradually difficult to meet the high reliability requirements of modern embedded software design [1]. It is necessary to combine the theories, techniques and methods used in mainstream software engineering to deal with complex software systems, such as component-based design, model-driven architecture, formal specification and verification. The model-driven embedded software design method has become a research hotspot in the field of embedded computing. The formal method is a mathematical based language for the specification, design and verification of the system. For embedded software systems with high reliability, it is very important to establish effective formal verification technology.

Therefore, the reliability of embedded software design can be greatly improved by introducing a formal method in the requirement specification stage of embedded software and generating a software architecture model preserving formal semantics according to the requirement specification.

Embedded system plays an important role in human life, the proportion of software in the system is increasing. Testing embedded software is one of the important means to ensure its quality. This paper starts from the characteristics of embedded software testing. The test methods and strategies of embedded software are discussed in detail, which are of guiding significance for improving and improving the quality of embedded software.

With the development of economy, the importance of enterprise financial data early warning and analysis is more and more important for the development of enterprise. Enterprise financial early

warning analysis is based on the analysis of enterprise accounting information and other related information.

In order to advance the financial analysis system of precautionary measures, the enterprise must establish a set of early warning system if it is faced with a crisis in the event that it is faced with a business crisis, it is necessary to inform the operators of the financial crisis that the enterprise is facing in advance. Enterprises can be told in advance to take effective contingency measures to eliminate the crisis. The so-called enterprise financial data early warning analysis system is based on the analysis of enterprise financial statements and related business information.

Using timely financial data and corresponding data management methods to inform the business operators and other interested parties in advance of the dangerous situation faced by the enterprise, And analyze the causes of the financial crisis and the hidden problems of the financial operation system of the enterprise, in order to do a good job of the financial analysis system of the precautionary measures early [2]. The application of this system can greatly reduce the financial crisis of the enterprise. It is very important to avoid the huge loss of economic property.

However, the traditional methods of data early warning and analysis can not meet the requirements of the development of modern science and technology, so we urgently need to study new methods of data early warning and analysis. Therefore, the security and reliability of the software must be guaranteed. Therefore, the formal method of software is adopted in the research and development of the data early warning and analysis system. Understanding and applying formal methods of software is bound to achieve a learning result with twice the result with half the effort. Formal methods of software are based on discrete mathematics and formal logic. It uses formal semantic symbols and tools to express the computer system for design, and strictly proves the nature and correctness of the system according to the system specification [3]. It is an important means to improve the security and reliability of software system.

Because different distributed real-time systems require different time characteristics, it is difficult to analyze the fuzzy time of distributed real-time systems. Time aspects such as uncertain time and fixed time. In order to simplify the complexity of multiple time confusion, these times can be classified and summarized. Aspect-oriented thinking requires that different time aspects can be expressed in different formal specification languages. The accuracy of distributed real-time systems can be guaranteed by formal analysis methods. The formal language is extended. In this way, the formal language can be suitable for the analysis, design and modeling of trusted distributed real-time systems.

In this era of rapid development of computer technology, the demand for computers is becoming more and more urgent, more software is needed to achieve various functions, and it is also more important to the collection and processing of software. As a new subject abstracted from software design, software architecture has become an important research field of software engineering.

The so-called software architecture refers to a collection of data and components [4]. In fact, with the increasing scale and complexity of software systems, software systems begin to attach importance to the global architecture and specifications. It is even more important than the selection of algorithms and even the design of data structures. The design and planning of this global structure is a problem to be discussed in software architecture.

In the abstract, the software architecture includes the description, interaction, composition and so on of the design elements that make up the system. Generally speaking is specific software. It is composed of each component and the relationship between each component, such a system, it is possible to become a larger system elements.

Up to now, it has been widely recognized that it is extremely important to design a suitable architecture for the software system, which is directly related to the long-term success of the project. Most of the current architecture descriptions are informal, which is a great obstacle to the success of our system projects.

2. Formal Analysis method of C language Real-Time system Operation

At present, most computer systems are embedded system. The embedded system is usually the safety system and real time system, which means that the system failure will lead to disastrous consequences, which means that their correct behavior depends not only on the logical calculation, also depends on the resulting time. Therefore, using a formal approach to modeling and validation of the embedded system, and constantly improve the correctness and reliability of the system has become a research direction of many scholars at home and abroad.

L.A.C presents an embedded system modeling and research method based on Petri net. The method introduces important features of PRES+ capture of the embedded system, the key attributes using CTL or TCTL formula to describe the system, finally using model checking tool to verify whether the automation system model satisfies the key properties of.F. modeling and verification of a configurable embedded system.

The method can be configured to use discrete event system specification (C computing model for complex embedded system modeling, then the model transformation input language for the UPPAL model checking tool to verify, and put forward the algorithm model to the language through car automation conversion complicated application system verifies the validity of the model proposed by.R.A a new method.

The formation of modeling and verification of embedded system based on adaptive modeling method based on abstract synthesis for layer formation Time will be a large number of components, thus formed into a hierarchical configuration configuration, greatly reduces the complexity of system design [5]. In addition, to ensure that components well defined, propose a formal computational model for the key requirements of automatic verification adaptive embedded system, as is shown figure1.

```
*/
const int BL = 51;
const real32_I B[51] = {
  -0.0002065522713,-0.000226547214, 0.0004031544086, 0.001880549942, 0.003317833412,
   0.002963684266,-0.0001542497339,-0.004378238693,-0.005723320413,-0.001299199299,
   0.006668355782,  0.01084690262, 0.004834618885,-0.009091915563, -0.01877111569,
  -0.01164214872,   0.0114138769,  0.03149983659,  0.02490338311, -0.01334423106,
  -0.05603076518, -0.05687624961,  0.01462198794,   0.1427659392,   0.2668988109,
    0.3182654977,   0.2668988109,   0.1427659392,  0.01462198794, -0.05687624961,
  -0.05603076518, -0.01334423106,  0.02490338311,  0.03149983659,   0.0114138769,
  -0.01164214872, -0.01877111569,-0.009091915563, 0.004834618885,  0.01084690262,
   0.006668355782,-0.001299199299,-0.005723320413,-0.004378238693,-0.0001542497339,
   0.002963684266,  0.003317833412, 0.001880549942, 0.0004031544086,-0.000226547214,
  -0.0002065522713
};
```

Figure1. The formation of modeling and verification of embedded system

The prime Yang proposed a delay coloring with inhibitor arcs Pert network real-time embedded system modeling and verification method based on, and the availability and practicability of the method is verified by case. Guo combined double transition Petri nets and object-oriented design methods of modeling of complex embedded system, and the feasibility and practicability of the design method is proved through simulation example. Above all kinds of modeling methods all the effective implementation of the formal verification of the model, but did not consider the modeling problem of crosscutting concerns, leading to the model complexity and inefficiency.

In 1932, Fitzpatrick used a single financial ratio and found that shareholders' equity / liability and net profit / stockholder's equity were the highest discriminant. In 1938, moreover, Secrist used only the balance-sheet ratio as an indicator [6]. The breakthrough found that the definition of financial failure is not only limited to bankruptcy, but also includes default of bonds, non-payment of preferred stock dividends and so on.

In 1968, Altman established the discriminant function by using the linear multivariate discriminant analysis method (LMDAs). That is Z scoring model, which overcomes the phenomenon that different indexes in the single variable model can obtain inconsistent prediction results for the same company.

The Odom&Sharda1990 year of the network model is based on the five variables of Z model. The neural network model is used to predict enterprise bankruptcy. The results show that the training sample

has a correct rate of 100%, and the retention sample of the failed enterprise is 81.75%. The sample of normal enterprises is 78.18, which shows that neural networks have strong financial forecasting ability.

Other statistical analysis methods in addition to the research methods mentioned above, some people try to use new research methods for research, others try to use new variable input research. In 2000, Fan also predicted the bankruptcy of enterprises, using the method of supporting SVM, as is shown by figure2.
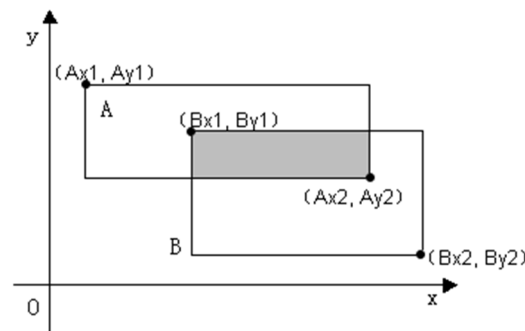

Figure2. Other statistical analysis methods

Digital filters are divided into low-pass, high-pass, bandpass, band-stop, all-pass and so on according to the frequency characteristics. According to the time-domain characteristics of its unit impulse response function, it can be divided into infinite impulse response (IIR) filter and finite impulse response filter (FIRs). Finite length unit impulse response (FIRs).

Digital filters can be made to have a strict linear phase. In addition, the unit sampling response of Fir filter is finite, so the filter must be stable, as long as it passes through a certain delay. Any non-causal finite length sequence can be transformed into a causal finite length sequence, so it is always possible to use causality system to realize the application function of .MATLAB in digital signal processing.

At present, the implementation of FIR filter can be divided into three kinds: using monolithic universal digital filter integrated circuit. DSP devices or programmable logic devices are implemented, in which the use of general DSP chip implementation is relatively simple, is a real-time, fast, especially suitable for the realization of various digital signal processing microprocessor. With the aid of the universal digital computer, the digital filter calculation is carried out according to the design algorithm of the filter. Because of its rich hardware resources, the improved Harvard structure. High speed data processing and powerful command systems are widely used in communication, aviation, aerospace, radar, industrial control, network and home appliances.

Trusted distributed real-time system put forward higher requirements on the system, it requires a distributed real-time system with reliable characteristics. Therefore, we can be trusted distributed real-time system is defined as consisting of a plurality of interconnected different types or different types of autonomous computing platform, they can cooperate in the implementation of a common task and requirements in a timely manner in response to external events to control the entire system, computing system to complete data processing within the prescribed period of time and output as expected results, and system behavior is the result of a predictable, controllable.

2 weave each time design method of software design aspects, every aspect must the combination of system, including the time. Because we have different design based on formal description language, can not be directly woven into different languages for this time, You must take time to achieve various aspects of language into a timed automaton, and then integrate the various aspects of the system, including the time synchronization problem. The main consideration each time and the behavior of the system, according to the different environment, different times, the behavior of systems can be well monitoring and synchronization, so as to achieve the desired results.

In fact, no matter how a software is designed, no matter how it is made, there is always an architecture. There is no software without architecture in the world. On the whole, any piece of software is based on the foundation. The body and decorating these components, that is, the infrastructure software that exists

on the operating system. And in detail, any subroutine also has its own structure. Few people have studied software architecture specifically before.

3. C language Model based on TMSVL

Since 1950s, with the development of digital signal processing technology, speech signal processing technology has been continuously improved, speech synthesis, speech recognition. Speech recording and speech control techniques have been gradually mature and applied [7]. In the process of speech signal processing, the accuracy and real-time performance of speech signal processing technology should be realized. Speech signal acquisition and error-free storage become the premise of speech signal processing. TMS320VC5402 is a fixed-point digital signal processor developed by TI. It adopts a modified Harvard structure. It includes one program storage bus, three data storage buses and four address buses.

This structure allows simultaneous execution of program instructions and operation of data at a high speed. The execution time of single-cycle fixed-point instruction is 10ns, which is much higher than the requirement of speech signal acquisition and processing. The precision and real time of analog signal to digital signal conversion (ADC) play an important role in the process of subsequent signal processing.

The future oriented modeling application technology in embedded system, the embedded system can effectively separate the core concerns and crosscutting concerns, not only help to improve the degree of modular model, there are formal verification to the model, many scholars in this field to explore.C.D describes how to use Theme/UML to support.

The modular design based on Theme/UML, and support the synthetic model and the source code of the automatic conversion of.N.M and puts forward a real-time embedded system oriented modeling method based on the direction of application. The method of using the MARTE term to describe the real-time constraints, and the design stage is the preparation of real-time constraints to standard application, thus converting standard application for real time the program, the method structure and behavior modification of standard application according to the rule. Zhang Lichen proposed a form of Aspect Oriented Real-Time System This method divides the real time system into different aspects, and then realizes every aspect individually. Finally, implicitly compiling the system is applied to implant these aspects into the system.

Analysis of the research results can be found, UML is extended to construct embedded system oriented model, the key attributes using temporal logic to describe the system, finally uses model checking to analyze and verify the model, is one of the most direct, the most natural way. Because of the finite state machine to describe the concurrent and hierarchical relations, complex embedded in the system therefore, this paper proposes a modeling method for complex embedded system based on State, the UML use case diagram, component diagram and States oriented direction, so as to realize the smooth transition of complex requirements to system implementation.

Planning and Coding Problem for an Electronic, published by von Neumann as early as 1947. The proof of program correctness is mentioned in Computer Instrument. Turing also did early work in this area in 1950. In the early 60s of the 20th century, Dijstra and others presented procedures to prove the use of "intuitive, visible" methods in the late 1960s. The proposal of "software crisis" in the NATO conference of software engineering has promoted the in-depth study of program verification. 1969. C. A. R. Hoare, "an axiomatic basis for computer programming" This paper formalizes the Floyd inductive assertion method. The axiomatic system of program verification is proposed for the first time, which is called Hoare logic axiomatic method.
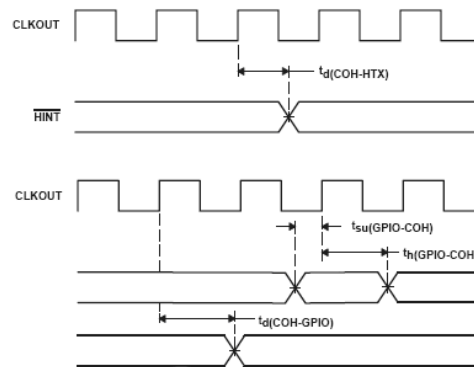
Figure3. The commonly used formal verification methods

The commonly used formal verification methods can be divided into two categories: deductive verification and model checking.

Status of domestic research:

On the Theory of Financial risk

From the end of 1980s or the beginning of 90s, China began to carry out financial risk research. Professor Yu Xuying believes that the greater the financial leverage coefficient of enterprises. The greater the financial risk, the greater the financial risk. If the firm has no liabilities, it is considered to be non-existent. Scholars call this risk as financing risk or debt financing risk. Professor Tang Guliang believes that "Financial risk occurs in financing, investment, income distribution and other financial activities, the role of various uncertain factors." The possibility that the actual income of the enterprise will deviate negatively from its expectations. " This definition can be seen as an extension of narrow financial risk. Dr. Xiang Dewei of the Ministry of Finance has analyzed the causes of financial risk in detail and comprehensively. Xiang believes that "financial risk is a micro-risk, is a concentrated embodiment of business risks."

Object - constrained language (ocl) is a formal specification language . It uses the expression syntax of text language , which is more simple and easy to learn than other specifications . ocl has a certain versatility and is suitable for many aspects . So we interpret ocl as other executable languages , so we can better describe the aspect - oriented extension of ocl .

Up to now, the research work on software architecture is still mainly carried out abroad. Up to now, the research on software architecture in our country is still in its infancy. Our domestic development of large and super-large complex software systems is much less.

In the current general software development methods, the general description is usually using non-formal diagrams and texts, but these diagrams and texts can not describe the interface between components that the system expects to exist. Nor can it describe the meaning of the composition of the different parts of the system, so it is difficult for developers to understand.

Now, when there is almost no formal method to describe each component in a software system, the reusability of the system will be greatly affected. It is difficult to migrate to a different system because it is impossible to transplant such a system without a formal description.

UML is a standardized modeling language of object-oriented software. UML can express dynamic and static information in software design because of its simple and unified characteristics. At present, it has become the industry standard of visual modeling language. In the development of software radio system, the unified modeling language can be used throughout the design cycle to help designers shorten the design time. Reduce the cost of improvement and optimize hardware and software segmentation.

4. A formal Analysis method of C language Real-Time system Operation based on TMSVL

Formal methods require certain mathematical foundation. Formal methods can accurately verify the software specification system, greatly improves the safety and reliability of.Z symbol software is such a kind of relevant data to determine characteristics of the very successful formal language, is a

description of the relevant data characteristics and static structure of powerful tools, but in the aspect of structural dynamic behavior model of the lack of corresponding functions.

With the complementary language real-time process algebra timed CSP is a set of dynamic behavior of powerful language, but it did not provide the appropriate structure to construct data related characteristics, also have some defects. So in order to support the several stages of real-time embedded system development process and the formal specification language Z and timed CSP are integrated to complement each other, complementary advantages.

With state description ability of Z and has a process The timed-csp integration of description ability is called RT-Z. It is one of the individual forms of smoothing integration. It belongs to retention integration, giving full play to the advantages of two languages, Z and timed CSP.

Introduction: embedded software is the software to realize the function of embedded computer system. Embedded software develops very fast, and embedded software develops faster. Embedded software is like biological development.

There are single cell organisms want to multicellular organisms, all the way to intelligent biological human, in this process, embedded software is more and more complex, embedded software is embedded in the hardware operating system and development tools software. Its relationship in the industry is reflected as follows: chip design and manufacture. →Embedded system. →Embedded electronic equipment development, manufacturing.
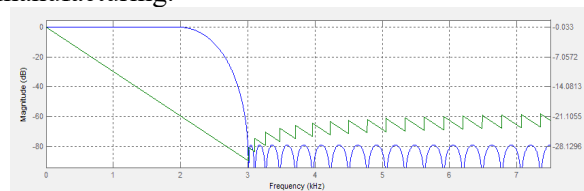

Figure4. single cell organisms want to multicellular organisms

An embedded system is defined as a system for performing independent functions. It consists of a series of microelectronic chips and devices, including microprocessors, timers, microcontrollers, memory, sensors, and so on. And embedded in the memory of the micro operating system, control application software components, such as real-time control, monitoring, management, mobile computing, data processing and other automatic processing tasks.

Based on microelectronics, control, computer and communication technology, embedded system emphasizes the cooperation and integration of hardware and software, and the tailoring of software and hardware. In order to meet the system function, cost, volume and power consumption and other requirements.

The simplest embedded system can only perform a single function of the control, such as the application of a single chip microcomputer, in the unique ROM only to achieve a single function control program. No micro operating systems. Complex embedded systems, such as personal digital computers, PDAs, handheld computers, HPCs, etc. It has almost the same function as PC. In essence, the difference between PC and micro operating system is to embed micro operating system and application software in ROM RAM and / or FLASH memory. Many complex embedded systems are composed of several small embedded systems.

Formal method. In software development there have been many controversies. Proponents of positive attitude believe that formal methods will lead to a revolution in software development. In a broad sense. Formal method is to solve the problems in software engineering field by means of mathematical method, including the establishment of accurate mathematical model and the analysis of the model. In a narrow sense, the formal method is to use formal language. Formal specification description, model reasoning and validation methods. As far as formal modeling is concerned. A formal representation must contain a set of formal rules that define its syntax semantics.

These rules can be used to analyze whether a given expression conforms to syntax. Or prove that the expression has some properties. The starting point of the formal method is the mathematical logic method, its purpose is to develop reliable software products. From the point of view of software

development. Formal methods are not the mainstream of software development at present. From the development of software, the early software was used for numerical computation, and the programming language focused on the description of functions and algorithms.

Later, the application of database and data structure became more and more important. Now the software is more complex, therefore, object, component, interface, communication, open and so on become very important concepts. There is a set of ways to describe these concepts, such as graphics, tables, logic, natural language, etc., to describe all aspects of a system. We can also study how to formalize these methods so as to make the description of software system more accurate so as to reduce the problems caused by possible misunderstandings. In order to improve the reliability of software, this paper studies how to add some formal methods to the process of software development.

5. Summary

At present, in the development and maintenance of computer software, there are a series of serious problems. In fact, it is since the birth of the computer. There is a "software crisis." as shown below:. 1. The cost of software development is increasing day by day .2. the progress of software development is difficult to control .3. the quality of software developed is poor .4.It is very difficult to maintain the software in the future.

And these problems are caused by many reasons, such as unclear user needs, no correct guidance theory, software scale is getting larger and larger, software complexity is becoming higher and higher. In order to overcome these software crises, people adopt the method of optimizing software architecture, and start the research of software architecture.

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