# Research on Adaptive Scheduling of Production Emergency Resources Based on Blockchain Technology

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**Abstract:** The current adaptive scheduling of production emergency resources is generally set with a single scheduling structure, and the scheduling function is very variable, leading to increased scheduling congestion. Therefore, the verification and analysis of the adaptive scheduling of production emergency resources based on blockchain technology are proposed. According to the actual adaptive scheduling needs and standard changes, the problem description and adaptive resource scheduling assumptions are carried out, the multi-objective optimal scheduling function is designed, the control of function changes is strengthened, the establishment of the objective function is achieved, the blockchain adaptive resource scheduling model is designed, and the block unit modification is used to achieve emergency resource scheduling. The final test results show that the adaptive scheduling congestion is better controlled below 2. 5 after several measurements and studies, which indicates that this self use scheduling method is more stable, safe, and has strong scheduling pertinence. It is more scientific for the distribution and adjustment of emergency materials, and has practical application value.

**Keywords:** Adaptive; Data dispatching; Emergency resources; Production resources; Blockchain technology; Emergency dispatching;

## 1 Introduction

In recent years, with the increasing demand for product manufacturing, the orders of some enterprises have gradually become diversified. Due to the limitations of production systems and production lines, as well as the limitations of external environment and specific factors, some enterprises often lead to problems in the production line, which requires multi-directional scheduling of emergency supplies. In general, small batch scheduling development[1-3]. Managers can directly participate in the whole scheduling cycle of resources, to a certain extent, they can promote the completion of scheduling work faster, resulting in strong random characteristics of the subsequent scheduling time, and to a certain extent, they can greatly increase the uncertainty of the production scheduling process, But at the same time, it also puts forward higher requirements for the dynamic collaborative network service capability and adaptive structure of production logistics scheduling resources (production resources and logistics resources)[4-5]. In fact, the scheduling of emergency resources in the production workshop needs to include a collection of resources manufacturing services related to daily tasks, improve the quality of manufacturing services, real-time costs and reliability through diversified ways, and design a multi-objective model of manufacturing services by integrating blockchain technology. The improved particle swarm optimization (PSO)

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algorithm is used to find the optimal approximate solution of adaptive scheduling, and gradually form a stable and multi-source resource scheduling structure. Therefore, an adaptive scheduling method for production emergency resources based on blockchain technology is proposed.

## 2 Design an adaptive blockchain scheduling method for production emergency resources

### 2.1 Problem Description and Adaptive Resource Scheduling Assumptions

This time, scheduling is mainly conducted from three aspects of total production time, total production cost and production quality to achieve optimal processing of the adaptive scheduling process, The existing production problems are described, and adaptive resource scheduling assumptions are established.

In order to compare the pre decomposition and post decomposition production emergency resource scheduling descriptions and keep consistent, the time interval of adaptive scheduling is increased. Establish a reverse scheduling model for adaptive processing, as shown in formula 1 below:

$$G = \min(\max(c_i)) \tag{1}$$

$$D = \sum_{U=1} \beta_U \times (1 - \alpha)^2 \tag{2}$$

Formulas (1) and (2): $G$ represents an adaptive processing model, $D$ indicates the constant value of the directional decomposition scheduling, $c_i$ represents the constraint interval, $\beta_U$ indicates scheduling deviation, $\alpha$ indicates the adaptive scheduling range[6-7]. According to the above settings, the adaptive processing model and the directed decomposition scheduling unit are designed. Next, integrate the actual scheduling needs and set goals, and then, based on this, assume the scheduling unit, and calculate the specific objective function in the process of production emergency resource scheduling and implementation, so as to further shorten the production scheduling cycle of products. In the front and back timing of emergency resource scheduling, integrate the blockchain technology to achieve constraints, and collect the adaptive scheduling timeBased on the number of resources scheduled, the number of resources available, and the scheduling time unit, a multi-directional conceptual scheduling model is designed, as shown in formula (3):

$$\begin{cases} S_J \geq \Re_{C_1} \\ C_1 = 1.5, C_2 = 0.5 \\ S_J \geq \Re_{C_2} \\ J \leq 1 \end{cases} \tag{3}$$

In formula (3): $S_J$ represents an adaptive scheduling model, $\Re$ indicates the dispatching range, $C_1$ and $C_2$ respectively represent the objective function and the equivalent scheduling value, $J$ indicates the front and rear constraint deviation[8-10]. According to the above settings, the calculation of the adaptive scheduling model is completed. In different decomposition cases, the comprehensive hypothetical scheduling of production emergency resources is carried out, and the flat integration of internal resources in the intelligent workshop is introduced to realize flexible self-organizing production scheduling services and dynamic production requirements, and complete scheduling matching.

### 2.2 Establishment of multi-objective optimal scheduling function

After completing the problem description and adaptive resource scheduling assumptions, the next step is to integrate the blockchain technology and establish a multi-objective optimal scheduling function. Assume that there are multiple abnormal production areas at the same time that require synchronous scheduling of production emergency resources, set different scheduling numbers in turn, and the set of product adaptive scheduling demand numbers is N={1, 2, 3, . , n};The demand for each kind of product scheduling is decomposed on the cloud platform. The task set of product scheduling is a two-way set. The task decomposition for a certain product demand is consistent with the initial objective function, and the optimization orientation standard value is calculated, as shown in formula (4):

$$f = \frac{\sum_{w=1} k_w + (1 - t)^2}{n} + g_t \tag{4}$$

In formula (4): $f$ indicates the total time of material dispatching, $n$ indicates the longest distance for scheduling, $k_w$ represents the assembly time, $g_t$ represents the weight coefficient. According to the above settings, complete the calculation of the total material dispatching time. Set it as the initial scheduling time standard to form a stable scheduling system.

### 2.3 Design blockchain adaptive resource scheduling model

After the establishment of multi-objective optimization scheduling function, we need to integrate blockchain technology to design an adaptive resource scheduling model. For the abstract adaptive scheduling problem, establish an equivalent scheduling model, consider the resource conditions and constraints of the scheduling problem, and optimize the scheduling objectives and their dependencies, as shown in Figure 1:

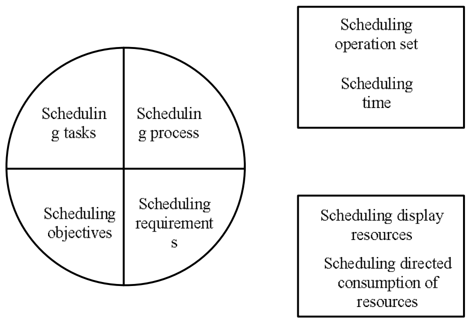


**Figure 1** Block chain adaptive resource scheduling model structure diagram

According to Figure 1, complete the design and analysis of the blockchain adaptive resource scheduling model structure. Based on this, we design a multi-stage scheduling process according to the scheduling tasks of production resources by integrating adaptive scheduling requirements and standards. Each process includes multiple data classifications and scheduling operations. After the adaptive scheduling process is satisfied, scheduling operations occur in sequence according to the execution time of the operation and the production priority of the operation. The scheduling emergency allocation problem of production emergency resources is mainly to schedule production materials, equipment, etc. to form more appropriate production scheduling tasks, form a diversified scheduling set, complete all production scheduling tasks within the set within the specified time, and meet the start time and end time of production tasks.

### 2.4 Block unit modification for emergency resource scheduling

After completing the design of the blockchain adaptive resource scheduling model, the next step is to integrate the blockchain technology and use the block unit real correction to achieve emergency resource scheduling.

Integrate the blockchain adaptive scheduling model, use scheduling information to trigger scheduling tasks, set the collaboration time of production scheduling, propose a real-time scheduling method to schedule production scheduling tasks or intelligent logistics, and optimize emergency material scheduling services considering the combination of current production and scheduling. According to the characteristics of dynamic scheduling requirements, a consistent cluster scheduling task model is constructed, and a self adaptive scheduling set is given to achieve the self-organization and adaptive goals of the cluster system. In addition, when the scheduler is triggered, the scheduling center can query the scheduling direction of production resources according to the task type to form a modified structure of the block unit, as shown in Figure 2:

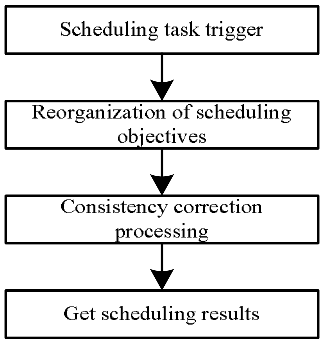


**Figure 2** Block Unit Modification Scheduling Structure Diagram

According to Figure 2, complete the processing and analysis of block unit correction. Compared with global scheduling, the modification and adjustment of real-time unit scheduling has the advantage of being able to handle high-frequency interference. Although the weight method and blockchain can achieve the basic goal of scheduling, repeated simulation can obtain better global scheduling optimization results. In the uncertain disturbance environment, the fixed weight method can achieve good scheduling results. With the continuous change of manufacturing system state, the consistency objective function of real-time scheduling service composition is established. Adaptive scheduling function is based on task characteristics to balance scheduling time and scheduling cost, arrange scheduling tasks at a given time point, reach an agreement with the task delay scheduling index, use the model to judge scheduling service quality, select appropriate scheduling production combination to complete real-time scheduling tasks, and then complete collaborative scheduling goals, This makes the global scheduling result stable and excellent in the disturbed environment.

## 3 Method test

In order to verify the practical application effect of the production emergency resource adaptive scheduling method based on blockchain technology, D production enterprise was selected as the main target object for the test, and a comparative method was used for analysis.

### 3.1 Test preparation

According to the specific tasks and conditions of production emergency materials scheduling, 10 different scheduling processes are divided, and the basic scheduling indicators and parameters are adjusted, as shown in Table 1:

**Table 1** Adjustment Table of Measured Index Values

| Scheduling operation stage | Dispatching setting | Scheduling time/s | Front drive scheduling deviation ratio |
|---|---|---|---|
| One stage | 0.354 | 1.03 | 3.5 |

| | | | |
|---|---|---|---|
| Two stage | 0.446 | 1.12 | 2.4 |
| Three stages | 0.487 | 1.15 | 2.6 |
| Four stages | 0.514 | 1.18 | 4.5 |

According to Table 1, complete the adjustment and integration of the measured index values. The mutation probability of the fixed scheduling is 0.5, the value interval of the scheduling population size is set as [10, 200], and the change scheduling step is 10, that is, the value of the scheduling population size is 10, 20, 30,., 200, respectively. With the help of Instance8. csv, the increase of block size within a certain scheduling range will improve the diversity of scheduling individuals, so as to avoid falling into the "trap" of scheduling local optimal solution, improve the optimization of the final scheduling solution, and complete the construction of the basic scheduling environment.

### 3.2 Test process and result analysis

After selection, the selected scheduling individuals perform crossover and mutation operations respectively to calculate the scheduling congestion, as shown in formula 5:

$$F = (1 - B)^2 \times \sum_{t=1} kt + \Re \qquad (5)$$

In formula (5): $F$ indicates the congestion degree of adaptive scheduling, $B$ represents the total amount of materials, $k$ indicates dispatching distance, $t$ indicates the scheduling time, $\Re$ Represents a scheduling unit. According to the above settings, the calculation of adaptive scheduling congestion degree is completed. According to the calculation results, a specific analysis is carried out, as shown in Table 2:

**Table 2** Comparative Analysis of Test Results

| Emergency material dispatching stage | Dispatching distance/m | Scheduling conversion ratio | Adaptive scheduling congestion |
|---|---|---|---|
| Phase 1 | 2.5 | 1.03 | 1.6 |
| Phase2 | 2.7 | 1.04 | 2.1 |
| Phase3 | 3.1 | 1.06 | 2.3 |

According to Table 2, the adaptive scheduling congestion degree finally obtained is better controlled below 2.5, which indicates that this self use scheduling method is more stable, safe, and has strong scheduling pertinence, and is more scientific for the distribution and scheduling of emergency materials, with practical application value.

## 4 Conclusion

This paper mainly studies and analyzes the adaptive scheduling of production emergency resources based on blockchain technology, adopts a new scheduling method of real-time dynamic collaborative emergency materials, and breaks through the scheduling problem of small batch and diversified production materials faced by enterprises. In the environment of industrial Internet of Things, the definition of adaptive scheduling of industrial clusters is proposed based on the new elements, characteristics and requirements of intelligent production scheduling. By analyzing the multi-level coupling of scheduling system and combining the specific characteristics of scheduling, a consistent block chain adaptive scheduling model is constructed to meet the real-time interactive scheduling needs of production of emergency materials in the form of intelligent production, Integrate the blockchain material collaboration mode, gradually form the task slack adaptive scheduling state model and the material real-time adaptive scheduling state model, further improve the collaboration capability of the blockchain scheduling mode, overcome the "short-sighted" shortcomings of real-time scheduling, improve the stability of intelligent production, follow the development trend, and promote further innovation of industrial production technology.

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