

Study on Compound Model of Forest-Pulp Enterprise Production Logistics Intelligent Distribution System

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Abstract

Through the study of forest-pulp enterprise production logistics pulping flow sub-system and production elixir flow sub-system, Petri nets model and the object-oriented model as the theoretical basis, and puts forward the enterprise production logistics subsystem compound model, and discusses the pulping process based on the composite model of logistics balance mathematical principle.

Keywords: Forest-pulp enterprise, Production logistics, Intelligent distribution, Compound model

1. Introduction

Along with the globalization manufacturing enterprise of specialization further refinement, some forestry-pulp-paper enterprise give up the original pulping process, by specialized factory over pulping on time, on need to offer various kinds of specifications pulp lump. Forestry-pulp enterprise production logistics system is discrete dynamic system (DEDS). Over the years, the researchers of discrete dynamic system model, analyze, optimize, and other aspects of the research in the very big progress, have developed many modeling technology. This modeling method can be generally divided into two categories: formal modeling technique and the formal modeling technology. Using a large number of mathematical methods through the state equation of the system were described and method of formal modeling technology called, such as queuing network, great algebra method, disturbance analysis, Petri nets method, etc; The graphic symbols or language description is close to the way people thinking habit of the system were described and the method known as the formal modeling technology, this kind of analysis of computer language implementation main, like simulation language, activity cycle figure, object-oriented programming technology, and so on.

Petri nets model of the dynamic characteristics of the system for a good description, especially for concurrent phenomenon, at the same time its graphic representation is easy to understand and accept, so Petri nets model has been become the discrete dynamic system modeling of the most active modeling technical one. In view of the complexity of the production logistics system and Petri nets of the gender characteristics, this paper will expand Petri nets in the outside world input and output interface open network system, and with object-oriented programming technology of forest enterprise production logistics slurry intelligent distribution system is launched research.

2. The Basic Concepts and Theoretical Basis

2.1 The Basic Concept of Petri Nets

Resources: system changes in the state related with system involves various factors, called resources. Including raw materials, semi-finished products, finished product, personnel, tools, equipment, data and information.

One petri net expressed as a five components in group, $PN = (P, T, I, W, G_0)$, among them:

$P = \{P_1, P_2, \dots, P_n\}$ as a limited library which collect, $n \geq 0$.

$T = \{T_1, T_2, \dots, T_m\}$ as a limited change set input function, $m \geq 0$.

$I: P \times T \rightarrow N$ as input function.

$W: T \times P \rightarrow N$ as output function.

G_0 : Is the initial signs. An initial identification with the nets as (PN, G_0) .

Petri nets from the view of a production logistics system, concentrated form for the two of the most primitive

concept: events and conditions. Event is the production of logistics system that happens in action. The occurrence of these actions by the state to control the logistics system, and these states can use a set of conditions to describe: a condition is the state of the logistics system attribute or logic described; a condition can be set up or not is established. Because the event is action, it can happen, also may not happen. An incident, could take several conditions was established at the same time, the condition is called the premise condition of events. The occurrence of event may cause the premise condition disappear and produce some other conditions, the latter is called event successor conditions or derivative conditions.

2.2 Object Oriented Basic Concept and Definition

"Object oriented" is a word for "process oriented" brought out, from essentially different from traditional structured a new method, the new way of thinking, is a kind of know the objective world view of the world. This world views the world as the objective of many different object form. Each object has its own internal state and internal movement law between different object, the relationship and forming a complete interact with each other and the objective world. On the other hand, "object oriented" is a kind of organization structure from the objective world simulation method, this method is composed of basic point of the objective world those basic ingredients, object, and the realization of the simulation is through the abstract, the objective world of the object is mapped to the computer system, and through the object was an abstract out the relationship between, interaction, so that the imitating system by simulation system and with the same or similar movement rules to accomplish the simulation of the objective world. Object oriented is of class, object, inheritance, overlap, message transfer and other properties, the biggest advantage is will the real world in various objects for abstract and classified respectively. Petri object-oriented model as shown in Figure 1.

2.3 The formation of the Composite Modeling Concept

A single modeling technology because of its characteristics and limitations, and can not perform well in from the system modeling, analysis to the verification of all tasks. Absorb all kinds of modeling technology advantage, improve and expand a single modeling technology, go the way of the cross modeling is to solve the complex system modeling, analysis and verification a new attempt.

Given the pulp of the complexity of the system of enterprise production logistics, simultaneity, randomness and other characteristics, ask the new model can describe complex system and not under the state space "index explosion" the impact of the; Ask the new model has become the input and output interface of the open model; Ask the new model is easy to understand, close to the way people used to describe graphics; Ask the new model can keep Petri nets analysis and verification ability, from the above requirements for the integration of the new model that there are two aspects: the expansion of the model itself; The comprehensive model. Exactly speaking, the basic Petri nets system will be expanded to foreign have input, output interface of recursion nets, while maintaining the basic nature of the network system does not change, that is still can use Petri nets mathematical tools to the new system is analyzed; The object-oriented model of the object model of news and methods with new meaning, and form event relation table, improve its dynamic model.

3. Forestry-Pulp Enterprise Production Logistics Subsystem Composite Model

Adopted complex model technology, with forestry- pulp enterprise as an example of pulping process modeling study. Through sorting, Forestry- pulp enterprise pulping process subsystem for production logistics can be shown in Figure 2. The image in a circle says production logistics collection of point and scattered points. We will further production logistics collection point, scattered points, pulping equipment abstract library (Place) have become, said the process of production logistics transmission pulp to branch or edge abstract for change, can be set up for enterprise production logistics slurry intelligent distribution system pulping process production logistics dynamic complex subsystem model as shown in Figure 3 below. Similarly, to get up the slurry enterprise pulping process production potion flow diagram 4, can be set up for the enterprise production logistics intelligence slurry pulping process production drug distribution system dynamic complex flow sub-system model shown as shown in Figure 5.

4. Compound Model based on the Pulping Process Logistics Balance Mathematical Theory Research

As shown in Figure 3 shows for the pulping process production flow sub-system wood compound model dynamic, if use to describe the incidence matrix, a matrix has G (library have several) line, M (total change) column; Incidence matrix with 0, + 1, 1 said changes and library respectively have not related to the repository, from change the direction of the output from the library, the library to change out of that input library. In fact, in most pulp production process in most library with most change is not related, quoted topology matrix, the only G line, D column. D is dynamic complex model is equal to (directed graph) of the most magnanimous.

Matrix elements a_{ij} associated with the library P_i said with a change in j of the T_j grade, labeled "-" said leave the library P_i , labeled "+" said that in library P_i . This paper will be the matrix named "label change topology matrix". The Figure 3 Lin plasma enterprise production logistics intelligent distribution system process production wood pulp flow sub-system dynamic complex models can be used below the topology of the matrix to storage:

$$A = \begin{bmatrix} T_1 & T_4 & -T_2 \\ T_2 & -T_3 & 0 \\ T_3 & -T_4 & -T_5 \\ T_5 & -T_6 & T_9 \\ T_6 & -T_7 & -T_{10} \\ T_7 & -T_8 & 0 \\ T_8 & -T_9 & T_{16} \\ T_{10} & -T_{11} & -T_{12} \\ T_{11} & -T_{14} & T_{20} \\ T_{14} & -T_{15} & -T_{18} \\ T_{12} & -T_{13} & -T_{17} \\ T_{13} & T_{15} & -T_{16} \\ T_{18} & -T_{19} & T_{22} \\ T_{19} & -T_{20} & -T_{21} \\ T_{21} & -T_{22} & -T_{23} \end{bmatrix}$$

Obviously, the label change topology matrix and incidence matrix, compared to the same storage pulping flow dynamic compound model, the more memory to much less.

Pulp production logistics process was set up G library, M change, I chemical element, J piece of degree level. In G library, and invigorating the water for the library is P , the library does for water is Q . So there are:

Production rate of the balance:

$$\sum_{m=1}^M d_{gm} \hat{f}_m = 0, g = 1, 2, \dots, G \quad (1)$$

Element balance:

$$\sum_{m=1}^M d_{gm} \hat{f}_m \hat{x}_{mi} = 0, g = 1, 2, \dots, G; i = 1, 2, \dots, I \quad (2)$$

Piece of class balance:

$$\sum_{m=1}^M d_{gm} \hat{f}_m \hat{y}_{mj} = 0, g = 1, 2, \dots, G; j = 1, 2, \dots, J \quad (3)$$

Level of element balance:

$$\sum_{m=1}^M d_{gm} \hat{f}_m \hat{y}_{mj} \hat{z}_{mij} = 0, g = 1, 2, \dots, G; i = 1, 2, \dots, I, j = 1, 2, \dots, J-1 \quad (4)$$

The water balance:

$$\sum_{m=1}^M (d_{gm} \hat{f}_m \hat{c}_m + \hat{w}_g / F) = 0, g = p_1, p_2, \dots, p_p \quad (5)$$

$$\sum_{m=1}^M d_{gm} \hat{f}_m \hat{c}_m = 0, g = q_1, q_2, \dots, q_Q \quad (6)$$

In addition, every change still exist constraints:

$$\sum_{i=1}^J \hat{y}_{mj} = 1, m = 1, 2, \dots, M \quad (7)$$

$$\sum_{i=1}^J \hat{y}_{mj} \hat{z}_{mij} = \hat{x}_{mi}, m = 1, 2, \dots, M; i = 1, 2, \dots, I \quad (8)$$

According to the least square principle, the objective function can be written as weighted squares of the form:

$$J_f = \sum_{m=1}^M \frac{(f_m - \hat{f}_m)^2}{2o_{fm}^2} + \sum_{i=1}^I \sum_{m=1}^M \frac{(x_{mi} - \hat{x}_{mi})^2}{2o_{xmi}^2} + \sum_{i=1}^J \sum_{m=1}^M \frac{(y_{mj} - \hat{y}_{mj})^2}{2o_{ymj}^2} + \sum_{i=1}^J \sum_{i=1}^J \sum_{m=1}^M \frac{(z_{mij} - \hat{z}_{mij})^2}{2o_{zmij}^2} \quad (9)$$

$$+ \sum_{m=1}^M \frac{(c_m - \hat{c}_m)^2}{2o_{cm}^2} + \sum_{g=pi}^{Pp} \frac{(w_g - \hat{w}_g)^2}{2o_{wg}^2}$$

5. Conclusion

Through the study of forest-pulp enterprise production logistics intelligence distribution system of composite model, we can draw the compound model based on the pulping process logistics balance mathematical theory, thus for production logistics distribution system of the application of intelligent provide theoretical support.

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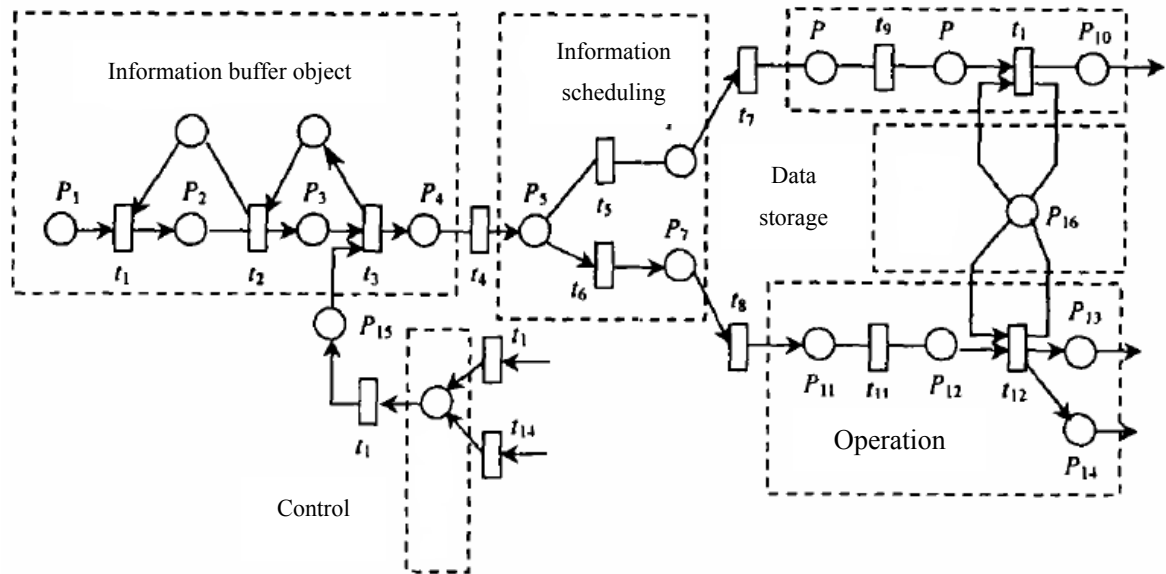


Figure 1. Petri object-oriented model

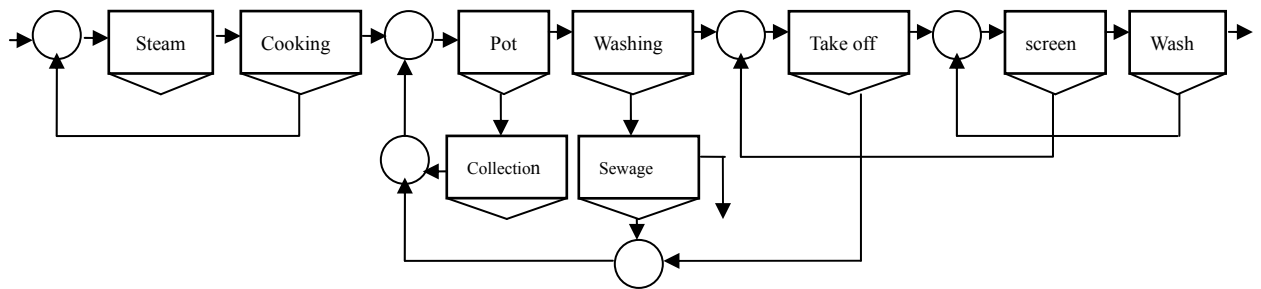


Figure 2. Forestry pulp enterprise pulp subsystem production wood flow schemes

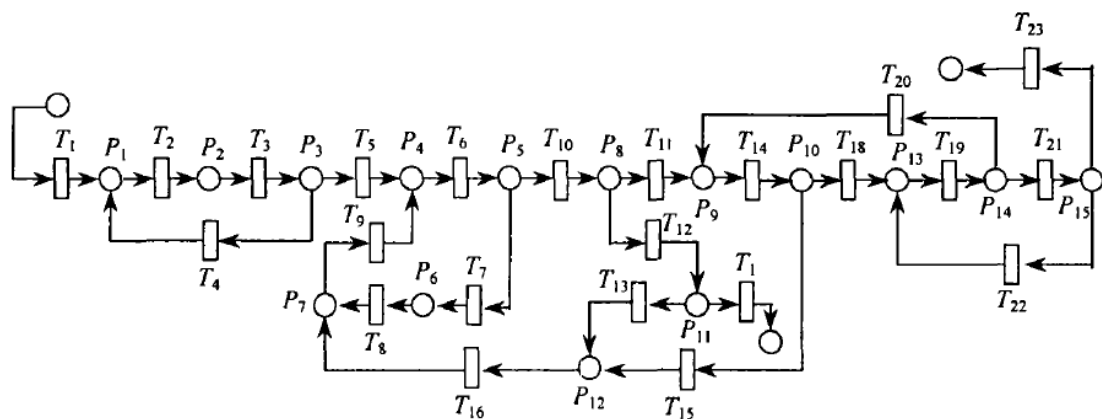


Figure 3. Forestry pulp enterprise production logistics intelligent distribution system process production wood flow subsystem pulping dynamic complex model

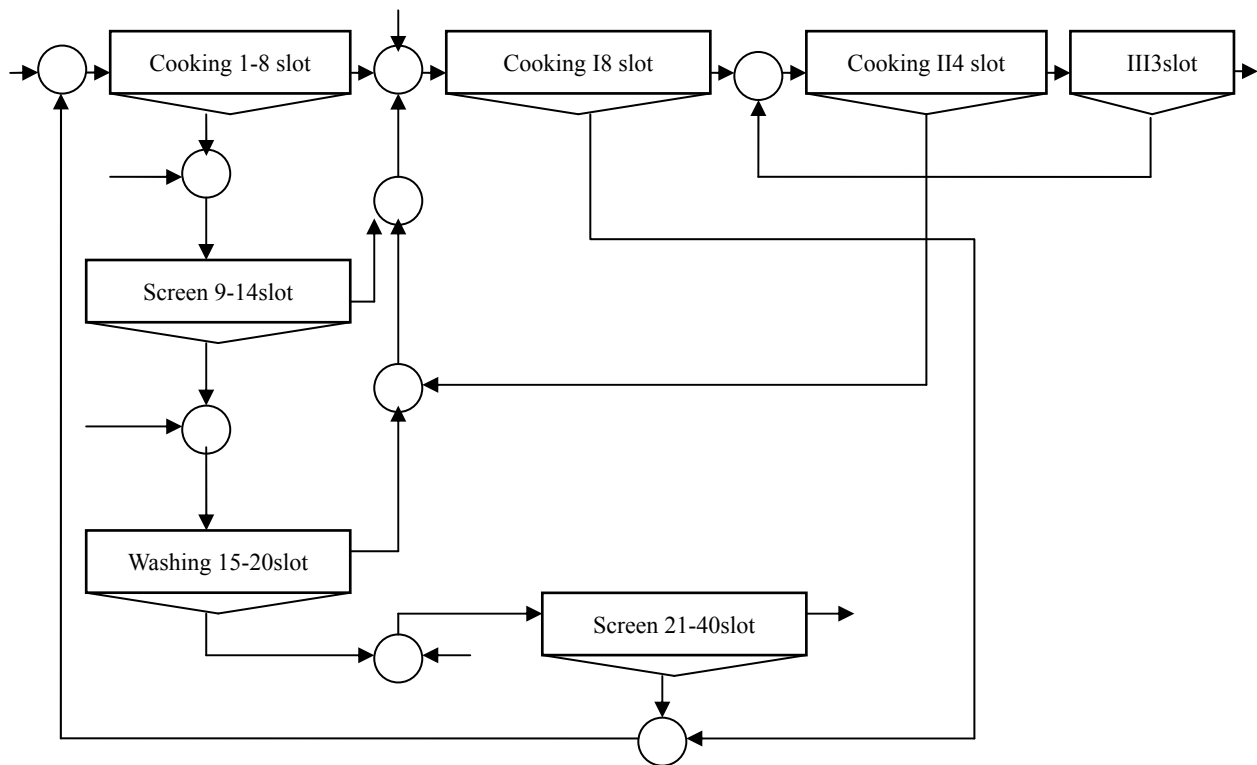


Figure 4. Forestry pulp enterprise pulp production elixir flow diagram

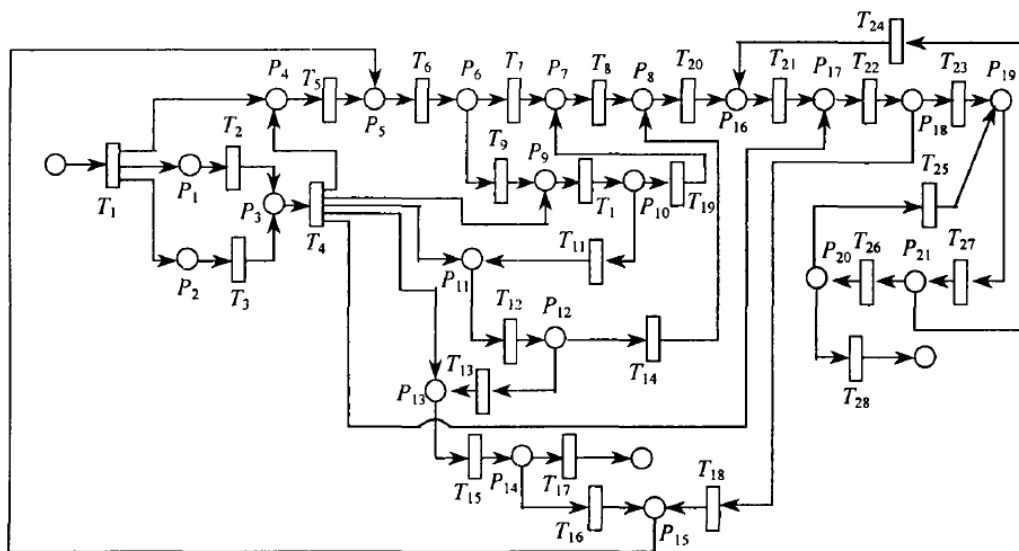


Figure 5. Forestry pulp enterprise production logistics intelligent distribution system process production elixir flow subsystem pulping dynamic complex model