Research and Application of the Optimal Furnace and Casting Schedule for Long Steel Products in Iron and Steel Enterprises

Qiaoshun Wu, Yun Jiang, TianYi Xiong and Haibo Peng

1,2,3 Yunnan Kisc Electronic Information Technology Co., Ltd, KunMing, China
4 Kunming University of Science and Technology, KunMing, China

*Corresponding author e-mail: email: pp.colly@163.com.

Abstract. This paper designs and implements an automatic grouping method for cascade production planning department and steelmaking plant in organizational production. The original data of group casting in this system is downloaded from SAP system to MES system by production planning department, and then decomposed into batch planning. Production plan data arrives in the database. After automatic calculation, judgment and other processing, the system triggers the next step of furnace group pouring operation. The whole process can timely and accurately form furnace number and pouring number data, and has traceability and data coherence. Triggering the next process execution improves the efficiency of information flow transmission. It solves the problem that the number of stoves and pouring times are not timely, rigorous, traceability and coherence are not enough in the process of organizing production in steelmaking plants.

Keywords: Steel-Making, Production plan, Furnace schedule, Casting plan

1. Introduction

At present, there is no specific furnace and pouring plan between the production planning department and the production management department of the steel plant. Generally, the dispatcher in the central control room of the steel plant makes a manual account according to the site situation. As a result, the timeliness of operation can not be guaranteed; the operator can not ensure to make timely plan adjustment according to the furnace number and pouring production situation on site. In addition to the dispatchers in the dispatching room of the steelworks, relevant departments, such as the general dispatching department and the production planning department, must turn to the manual account for analysis if they want to obtain the actual situation of furnace and pouring production in the production plan of this month. This paper-based operation mode is very backward, which leads to inconvenient data management, errors in furnace number and pouring number data, file loss and other situations, which will cause great losses, and is quite unfavorable to production organization. Therefore, this paper designs a set of steelmaking production plan to automatically form furnace schedule and pouring schedule, and implements this method in the production management system. The whole production
process can be seen and controlled in the system in real time. Good application effect has been achieved.

2. Overall design
In this system, the method of automatic distribution of furnace number and pouring number information between production planning system and steelmaking plant management system includes production order selection module 1, furnace group module 2, casting group module 3, pouring number adjustment module 4, pouring number data distribution module 5 [2], as shown in Figure 1, production order module 1 obtains data through the distribution of production planning department, and generates data according to furnace group standard through furnace group module 2. Furnace No. [4], the casting No. is generated according to the group casting standard through the group casting module 3. The General Dispatching adjusts the actual demand in the steelmaking plant through the adjustment module 4, and finally issues the casting information through the data distribution module 5. If successful, the rigid data status is issued, and the steelmaking plant organizes production according to the casting information.

![Diagram](image-url)

Figure 1.

The business process designed in this system is as follows:

A. according to the monthly production plan established by the production planning department in the enterprise resource management system, download and save the plan information to the production plan management system, and provide data reading support for the preparation module [5];

B. read the production plan information of this month from the production plan management system, prepare the furnace schedule according to the furnace group standard, and then save the furnace schedule to the production management system;

C. read the furnace number information from the production management system, adjust and select the furnace number information to be inserted according to the group pouring principle standard, form the pouring plan of the steel plant, and save the pouring plan information to the production management system;

D. the adjustment module reads the pouring information from the production management system, forms the cutting plan of the production pouring according to the production specification, and saves the cutting plan information to the production management system;

E. after the production pouring plan and cutting plan of the steel plant are confirmed by the general dispatching department, the confirmed data will be sent to the production execution system of the steel plant to guide the steel plant to organize production [8] and complete the production plan management process of the steel plant.
3. Concrete realization

As shown in Figure 2, the system automatically calculates and forms the work flow and implementation processing method of group furnace group pouring preparation according to the steel-making plan. The specific implementation method is as follows:

A. production order acquisition: receive the production order with material design;

B. statistics of production order quantity; statistics of whether the production order meets the furnace capacity and furnace assembly standard [3];

C. furnace assembly: according to the relevant metallurgical specifications, furnace assembly standards (specifically furnace capacity, brand, section, length, standard number, residual material minimization), and according to the delivery date, priority, equipment maintenance plan, production line, product form or one or several conditions in the transportation mode, a furnace assembly plan is formed [1];

D. furnace number acquisition; obtain the furnace number in accordance with the group pouring in sequence according to the group furnace plan;

E. group pouring: a pouring plan will be automatically formed after multiple heats are calculated according to metallurgical standards and group pouring standards [7] (specification, brand, heat information, etc.) and multi-dimensional information such as steel rolling demand, equipment operation, molten iron supply in ironmaking plant, alloy auxiliary material supply and energy control [9];

F. the steelmaking plant dispatcher confirms the pouring plan in the system [6], if it is confirmed to be passed, the pouring plan will be issued and the production will be organized according to the plan; if it is not confirmed to be passed, it will return to modify and adjust the pouring plan.

G. repeat the above steps when the new order data arrives.
When it is necessary to adjust the furnace arrangement plan and casting arrangement plan, the adjustment process is shown in Figure 3:

![Diagram]

**Figure 3**

A. obtain the pouring plan: obtain the pouring plan to be adjusted;
B. judge whether to cancel the plan. If the condition is "yes", cancel the whole pouring, delete all heats under the pouring, and delete the whole pouring;
D. judge whether to cancel the plan. If the condition is "no", select the heat information to be cancelled; delete the heat information under the corresponding pouring; obtain the pouring plan to be modified; recalculate and generate a new pouring plan under the pouring plan[10];
E. complete the adjustment of furnace and pouring plan, and issue to the production organization.
4. Conclusion
The design of this system has the following characteristics: 1. The order information to be produced is automatically obtained and distributed from SAP by the production and mining department; 2. The production technology office maintains the group furnace and group pouring standard according to the production brand information; 3. The pouring information data is transmitted through the enterprise LAN; 4. The whole process is automatically group furnace and group pouring according to the standard without manual participation in the calculation, so as to make the whole process complete. Each production process is visible and controllable, greatly improving production efficiency.

References
[1] Dong Hongyu, Huang Min, Wang Xingwei. Flexible integrated steelmaking furnace schedule. Computer Engineering, 2009, 10:24-26.
[2] Han Zhixing. Research on integrated steelmaking furnace batch planning based on robust optimization method [J]. Journal of system simulation, 2009, 12:43-47.
[3] Ning Shushi, Wang Wei. Hot rolling batch planning model and algorithm [J]. Journal of system simulation, 2007, 19 (3): 11-14.
[4] Zhu Li, Lushan suhongye. Rolling batch production planning model based on flexible optimization, computer integrated manufacturing system, 2014, 09:21-23.
[5] Chen Guang. Flexible production research and management information system development based on mass customization, computer engineering and application, 2014, 06:8-11.
[6] He Zhen, Che Jian Guo, Cui Anqing. Research on some problems in the implementation of mass customization. Journal of Northeast University (SOCIAL SCIENCE EDITION), 2006, 03:10-13.
[7] Zheng Zhong Liu Yichen open, unified model and intelligent algorithm for steelmaking continuous casting hot rolling production planning, engineering science journal, 2013, 09:31-35.
[8] Liu Han, Zhang Wenxin, Zhang Wenwen modeling of steel rolling joint production scheduling system based on UML, computer engineering and science, 2012,03:22-25.
[9] Tang Lixin, Yang Zihou's optimal casting schedule for steelmaking and continuous casting. Journal of Northeast University (NATURAL SCIENCE EDITION), 1996, issue 5: 31-33.
[10] Li Yan, Liu Jianrong, Li Tieke, research on optimal pouring schedule model based on constraint planning, metallurgy automation, 2007,03:7-10.