Energy Commodity Logistics Planning method based on Machine Learning method

Hongchao Jiang*

School of Modern Post (School of Automation), Beijing University of Post and Telecommunication, Beijing, 100876

*Corresponding author: hcJiang@bupt.edu.cn

Abstract. In order to cope with the increasingly fierce competition in the market of refined oil products, improve the level of logistics operation and achieve logistics efficiency, a transportation scheduling method of refined oil logistics based on dynamic programming model was proposed to improve transportation efficiency, reduce logistics costs and increase enterprise benefits. Firstly, the basic ideas of logistics and transportation scheduling of refined oil were analyzed, and the comprehensive system of logistics and transportation scheduling of refined oil was constructed. The statistical analysis and sampling of logistics and transportation scheduling of refined oil were carried out by adopting the adaptive dynamic programming method, from which the characteristic values of association rules which could reflect the level of logistics and transportation scheduling of refined oil were extracted. Big data information fusion method is used to optimize the dynamic planning and transportation mode of refined oil logistics and transportation scheduling, and the spatial dynamic programming model of refined oil logistics and transportation scheduling is established. Combined with pattern recognition and path optimization method, the optimal design of refined oil logistics and transportation scheduling model is realized. The simulation results show that this method has good adaptability to transport scheduling of refined oil logistics, and the transportation efficiency of refined oil logistics is improved, the route is optimized, the level of enterprise guarantee is improved, and the logistics cost is reduced, which provides a strong guarantee for expanding the market and increasing the efficiency.

Keywords: dynamic programming model refined oil logistics scheduling method logistics efficiency.

1. Introduction
In recent years, the international oil price has fluctuated, the domestic oil industry has successively released refining capacity, the growth of refined oil consumption demand has slowed down, and the refined oil market is in the situation of supply exceeding demand for most of the time. In addition to the two giants Sinopec and PetroChina, China National Offshore Oil Corporation and Sinochem also joined the onshore oil market competition. Foreign and private enterprises and local refineries are also growing in strength, and the competition in the refined oil market is becoming increasingly fierce. The increasingly fierce price war, oil prices are not in place for a long time, the ability of enterprises to create...
efficiency is seriously impacted. In this market environment, it is particularly important to use scientific scheduling methods to improve the level of logistics distribution and transportation of refined oil products, to realize high-quality logistics transportation, to optimize transportation direction, to reduce transportation and miscellaneous expenses, and to improve the ability of guarantee and supply and the ability of logistics efficiency creation.

2. Integrated architecture modeling and information sampling

In order to optimize the logistics and transportation process of refined oil, this paper proposes a logistics and transportation scheduling method of refined oil based on dynamic programming model. Firstly, different transportation modes of refined oil, such as pipeline transportation, railway transportation, waterway transportation and road transportation, are analyzed. On this basis, a comprehensive system model of refined oil logistics transportation scheduling is built, and a hybrid network scheduling mode is adopted to carry out transportation route planning.

Firstly, the spatial planning model of refined oil logistics transportation scheduling is described as follows:

\[ C = \frac{ts+1}{\lambda s+1} \]  

Among them, \( t \) represents the average transportation time, \( s \) represents the average transportation distance, and \( \lambda \) represents the number of tasks of the refined oil transportation scheduling project. Suppose the dynamic constraint parameter model of product oil logistics and transportation scheduling is \( x = \{x_1, x_2, \ldots, x_i\} \), then in the dynamic interval, the normalized orthogonal basis is used for the adaptive optimization of product oil logistics transportation scheduling, and the optimization function is assumed to be \( g(x) \), and Levenberg-Marquardt equation is used to construct the boundary value solution of product oil logistics transportation scheduling. Combined with the boundary value periodic solution and dynamic constraint parameter model, the input parameters of oil logistics transportation scheduling are adjusted, namely:

\[ f = x_{mj} - B_{\text{max}} g(x) \]  

Wherein, \( B_{\text{max}} \) represents the extreme value of the boundary value solution of the transportation scheduling of refined oil logistics. If \( F \) has a positive periodic solution at \( B_{\text{max}} \), it can be interpreted that there is a time delay effect in the process of petroleum logistics transportation scheduling. Let \( \sigma \) be the fuzzy characteristic quantity of transportation scheduling of petroleum logistics. In the normalized linear subspace, there exists the concept set of transportation scheduling of refined oil logistics:

\[ F(x) = C \sum_{i=1}^{N} x_{ij} + \sigma t \]  

With the increase in the number of entities involved in refined oil logistics, based on the concept set of transportation scheduling of refined oil logistics obtained above, a comprehensive architecture of logistics scheduling is constructed by using grid space planning method, as shown in Fig. 1.
According to the grid model shown in Fig. 1, the integrated system design of refined oil logistics transportation scheduling is carried out by means of pipeline transportation, railway transportation, waterway transportation, road transportation, etc., and the optimization scheduling and control of refined oil transportation logistics is carried out by integrating primary logistics and secondary logistics.

3. Dynamic Planning and Design of Logistics and Transportation Scheduling of Finished Oil Products

On the basis of the above research, the big data information fusion method was adopted to carry out the dynamic planning and optimal control of transportation mode of refined oil logistics and transportation scheduling, and the adaptive adjustment of refined oil logistics and transportation scheduling was realized according to the feature extraction results. Adjustment error during transportation is as follows:

\[ e = \frac{c}{m} - R \]  

It is assumed that Y-round scheduling is carried out in this transportation scheduling task, and spatial planning technology is used to plan the transportation routes of refined oil logistics, and the throughput of Y-round scheduling can be obtained as follows:

\[ T = y(X - 1) \times \frac{R}{L} - e \]  

Combined with the spatial dynamic planning model of refined oil logistics transportation scheduling established above, the method of pattern recognition and path optimization is used to assume that the refined oil transportation dispatching center is Q, and the optimal dispatching route planning is carried out with the average value of the measure information between nodes. For m+n transportation scheduling nodes, the optimal scheduling model is as follows:

\[ G = L\{T \times (m + n) \times \frac{q}{m+n} - e\} \]

To sum up, the optimization design of logistics and transportation scheduling model of refined oil has been realized, which lays a foundation for improving the capacity of distribution and transportation of refined oil logistics.

4. Experimental test analysis

In order to verify the application performance of the above dynamic programming model-based refined oil logistics transportation scheduling method in the realization of refined oil logistics transportation scheduling and dynamic planning, the following simulation experiments are designed for verification.
Set the number of nodes for pipeline transportation as 12, railway transportation as 20, waterway transportation as 15, road transportation as 80, the coordinate of dispatching center as (0,0,0), and the scheduling delay as 1.25ms. The petroleum logistics transportation scheduling model is constructed according to the above simulation parameter settings, and the dynamic volume distribution of refined oil logistics is obtained, as shown in Fig. 2.

![Figure 2 Distribution of refined oil logistics transportation](image)

According to the product oil logistics transportation throughput distribution shown in figure 2, product oil logistics transportation scheduling and dynamic planning are carried out to achieve balanced transportation scheduling. Under different iterations, the oil transportation scheduling output waveform of the refined oil logistics transportation scheduling method based on dynamic programming model is shown in figure 3.

![Figure 3 The balanced dispatching output of refined oil logistics transportation](image)

It can be seen from the analysis of Fig. 3 that, under different iterations, the output waveform of balanced scheduling of refined oil logistics transportation by this method is relatively stable and has a certain fluctuation rule, which proves that this method can effectively realize the scheduling and
dynamic planning of refined oil logistics transportation, improve the throughput efficiency and achieve good output balance.

5. Conclusion
In order to improve the level of logistics transportation of refined oil, it is necessary to establish the optimal scheduling model of finished product logistics transportation, so as to realize the efficient transportation of refined oil logistics. Therefore, this article put forward product oil logistics transportation scheduling method based on dynamic programming model, for a variety of product oil transportation way to set up the comprehensive system of product oil logistics transportation scheduling, on the basis of the refined oil logistics transportation scheduling dynamic programming optimization control and transportation mode, establish space dynamic planning model of product oil logistics transportation scheduling, and combined with pattern recognition and path optimization method, the optimization of product oil logistics transportation scheduling model design. It can be seen from the experimental study that after adopting the logistics and transportation scheduling method of refined oil based on the dynamic programming model proposed in this paper, the logistics and transportation scheduling method of refined oil has good adaptability, the transportation direction is optimized, and the ability of guarantee and supply is effectively improved, which is beneficial to the refined oil sales enterprises to reduce the transportation and other expenses and improve the efficiency ability.

Reference
[1] Li Yinya. Research on the optimization of strategic petroleum reserve under supply interruption scenario [D]. Jiangsu: Jiangsu University of Science and Technology, 2016.
[2] Li Jie, Fei Long, Liu Zhaopeng. Application of Dynamic Programming in Shortest Path Problem of Logistics Distribution [J]. Journal of Jilin University of Chemical Technology, 2016 (11): 117 -- 121.
[3] Li Bing, Xuan Hua. A Stochastic Dynamic Fleet Scheduling Strategy Based on Job Coordination [J]. Control and Decision, 2017, 32 (1): 71 -- 78.
[4] Wang Xuejun, Li Sha, Yang Lixia. Research and Application of Oil Data Analysis Model Based on Big Data Platform [J]. Journal of Chengde Petroleum College, 2018, 20 (3): 32 -- 34+38.
[5] Yang Yunfan. Design and Implementation of Logistics Navigation System Based on Internet of Things [D]. Guangzhou: South China University of Technology, 2017.
[6] Guo Liang. Analysis on Vehicle Scheduling Problem of Refined Oil Secondary Logistics Distribution [J]. Chemical Industry Management, 2018 (10): 27 -- 28.