Dynamic Programming of Ethylene Production Planning Integrated with Scheduling

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Abstract

Introduction

Planning and scheduling are two important activities for stable production and efficient operation of the petrochemical industry. Optimal planning and scheduling scheme can greatly increase the profit for a company with high cost of raw material and operating expenses. Previously ethylene production planning model utilizes linear programming method. However, a static planning model eliminates the capacity changing of the cracking furnace system which influences the product yields.

Methodology

In this work, a dynamic programming model of ethylene production planning is built to optimize the profit of a plant with the capacity distribution scheduling of cracking furnace system. Dynamic programming method is utilized to decompose the planning optimization problem into a series of scheduling problems which contain the capacity variation according to the practical needs. Each scheduling problem optimizes the average daily profit of the key products to get the capacity distribution of cracking furnace system, and the key product yields model with the capacity variation of the cracking furnace system is built.

Results and Discussion

By applying the dynamic programming model, the maximization of the monthly profit of the ethylene plant is performed and the optimal capacity distributions of each furnace are maintained. Compared the optimal scheme with the original linear programming method of the planning problem, a larger profit of a monthly planning scheme is obtained and an exclusive scheduling scheme for the capacity distribution of the cracking furnace system is proposed.
Linear programming is a static optimization method with a limited searching space so that it is hard to reach the global optimal point of the production planning. With the dynamic characteristic of the production process considered in the optimization problem, the searching space can be expanded so that a better optimal point can be reached.

**Conclusion**

The dynamic programming method works successfully in production planning of an ethylene plant. The ethylene production planning is more accurate for the production process and the capacity distribution scheduling provides theory basis for the operation to decide the capacity of each furnace.