

Modeling and Design of Conveying System

The role of warehouse in the distribution trade is not only to keep products in good conditions but also to manage and arrange the stock to ship them as soon as they are ordered. As shopping through the Internet has got more popular recently, the demanded capacity and performance for the warehouses have become higher. Thus the distribution system is being mechanized and controlled electrically and machines are widely used in warehouses. However, the design of automated warehouse has relied on by skillful system engineers' experience and there was no formulized method established up to now. Thus the design results differ upon the people. It was inefficient not only because the calculation took a lot of time but also because there are so many reworks for a design. Especially, the size of buffer, which is used as temporary storage area for machines to pass loads to another, is difficult to estimate because to know the actual operation situation at design phase is usually impossible.

In this study, a mathematical model called "queuing network theory" is adopted to calculate the size of buffer as well as the number of machines. In the proposed method, warehouse system is modeled a network; nodes represents machines and loads go around the network. The result implies that without any constraint there is a possibility that the necessary size of buffer is too large. And through simulations, the buffer proved to be large enough to temporarily storage loads, which suggests the appropriateness of the proposed method.

Keywords: Queuing network theory, Automated warehouse, System design, Conveying system

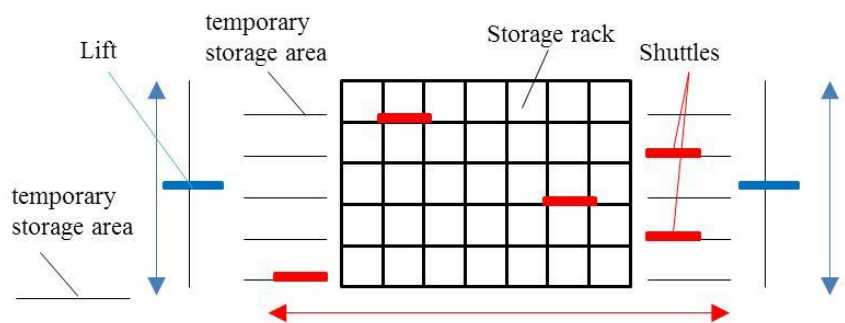


Fig. 1 An example of automated warehouse system. Lifts and shuttles convey loads and buffers are necessary among them.

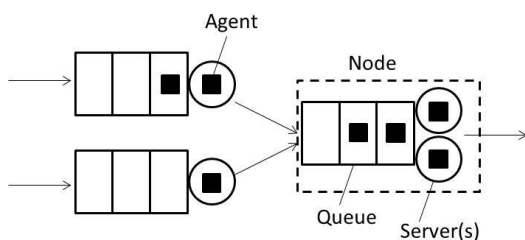


Fig. 2 Outline of queuing network. Loads wait in the queue until they go to the front of it and are conveyed by machines.

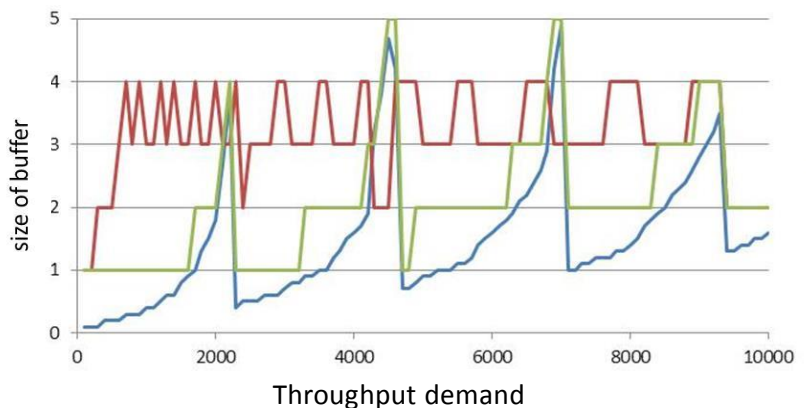


Fig. 3 Change of buffer size according to the throughput demand