Design of Buffer Size in Warehouse System

Buffers that are temporary storage area for jobs handover are widely applied in warehouse systems. Insufficient buffer size lead to too much congestion and blocking while excessive buffer size hamper the whole systems. In order to increase the working efficiency of the warehouse systems, proper buffers should be designed. However, jobs flow in real warehouse systems are very complex due to congestion and blocking, so it is difficult to measure the performance of the warehouse systems and evaluate the designed buffer size. In addition, more factors including blocking type and operation mechanism should be considered to analyze the different configuration of the systems, which increases the difficulty of performance measure of warehouse systems.

In this study, we proposed an automatic calculation algorithm to evaluate the performance of a warehouse system with designed buffer size. We modelled and solved the warehouse system based on queueing network theory and used Breath-First Search to make the whole modelling and calculation process automatically. Some numerical examples have been calculated and the calculation results were compared to the data from companies in related field (Figure 1). The results demonstrated the performance of warehouse systems including designed buffer with different configuration can be evaluated quickly with enough accuracy. In future, we will develop an automatic buffer design algorithm to design buffer size according to the calculation of performance of the systems with previous designed buffers.

Keywords: Warehouse system, Buffer Size, Blocking, Performance Measure, Automatic Calculation

Reference

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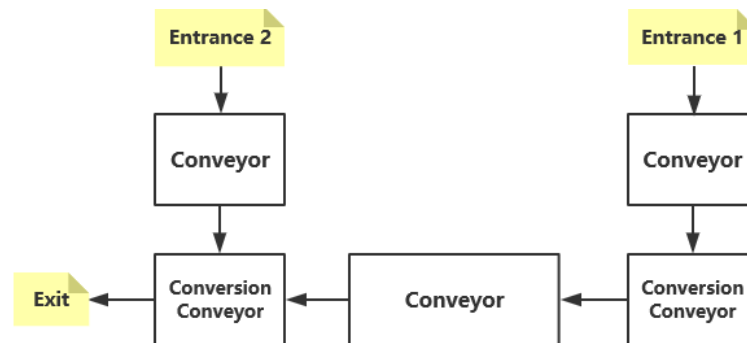
Fig 1. Numerical example: jobs enter the system from entrance 1 and entrance 2, and depart the system from exit. Arrows represent jobs flow direction. Throughput that is the rate at which jobs depart form the system was calculated.