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Integrated Design for AGV systems

In this study, we present a method of an integrated design for automated guided vehicle (AGV) systems. Recently, a material handling system using AGVs (Automated Guided Vehicles) have been used in manufacturing factories. AGVs are programmable material handling equipment. These vehicles circulate on a guide-paths network and transport materials among storages and machines in the factories (see Fig.1). Generally, the design problem for AGV systems divides into three sub-problems; a fleet size design problem, a flow path design problem and a transporter routing design problem. The Fleet size design problem is the issue how many AGVs are needed in the systems. The flow path design problem is the issue how to put guides on the floor of factory. The transporter routing design problem is the issue how to operate AGVs. In this study, we solve these three problems. It is better for the workers that there are not many aisles of AGVs at these AGV systems, because AGVs and workers work together in the factory.

It is important that these three problems influence each other. Therefore, they should not be dealt independently. For the high perform AGV systems, integrated design process of three design problems is needed. In this study, we propose a method of an integrated design for AGV systems.

For this purpose, we propose the method that takes three steps. 1) We classify exhaustively the transporter routing. 2) We determine the number of AGV for the systems. 3) We calculate the suitable flow path for the various kinds of transporter routing. In 1), we divide the transporter routing into their quality and quantity of the information when we plan actions of AGVs. The information is the perception of other AGVs and the knowledge of task. In 2), we put guide-paths completely in environment. Then, we simulate material handling with an AGV using one of the transporter routing. Until task is completed, an AGV is added to the system. The final number of AGVs is minimum number of AGVs. In 3), we calculate the suitable flow path with solving an iterative direct problem using genetic algorithm (GA). In our method, the genes represented binary indicate connections of the cells.

With our method, we obtain the set of transporter routing, the number of AGVs, and flow path (see Fig.2) by simulation. In this result, we can construct the short and straight flow path with the minimum number of AGVs.

Keywords: AGV, integrated design, transporter routing, flow path design

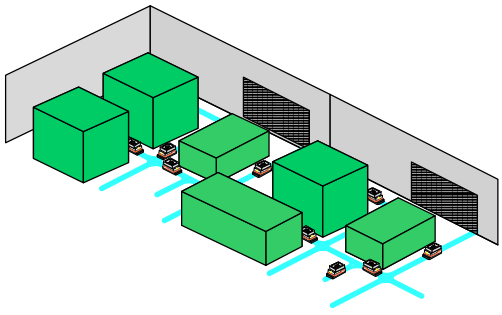

Fig. 1 AGV systems

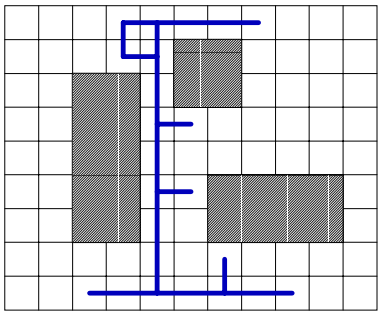

Fig. 2 flow path network