Integrated Design for AGV Systems Using Co-Evolution
(Dr. R. Chiba, Prof. J. Ota, Prof. T. Arai)

Recently, manufacturing systems must have much flexibility to cope with dynamic changes of their environment. The AGV (Automated Guided Vehicle) transportation system is one of flexible manufacturing systems to realize the demand above mentioned (Fig.1). In this research, three design problems should be solved for the effective system, (1) to design a flow-path network so as to guide AGVs, (2) to design a transporter routing so as to complete the transportation and (3) to design both with each influence. The effectiveness is defined based on the number of transportations and the shortening of the flow-path network.

Therefore, we propose the methods as follows, (1) to design a flow path network using Genetic Algorithm (GA), represented the genes as the arcs of network, (2) to parameterize a transporter routing based on an amount of information in multi-agent planning and to calculate the proper parameters using GA, (3) to design both using cooperative co-evolution. Compared with the other methods (Fig.2 and Fig.3), an appropriate AGV system can be designed by this method (Fig.4). In this system, the network designed with our method is less crowded than the other networks and the number of conveyances is as many as the system design with the other methods.

About the cooperative co-evolution in our method, a partner selection and a cycle of evolving are considered for an effective system design. The effectiveness in this method is larger than the canonical co-evolution methods.

Keywords: Automated Guided Vehicle, Flow Path Network, Transporter Routing, Co-evolution

References

1) R. Chiba, J. Ota, T. Arai, "Integrated Design for Routing and Network in AGV Systems using Co-evolution," Proc. IEEE Int. Conf. Robotics, Intelligent Systems and Signal Processing, pp .318-323, 2003.
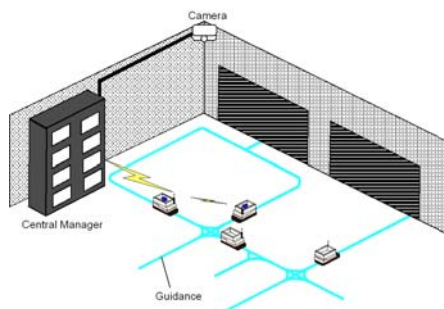
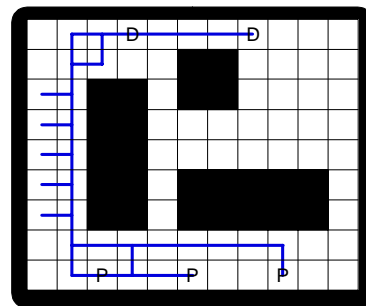Fig. 1   AGV transportation system
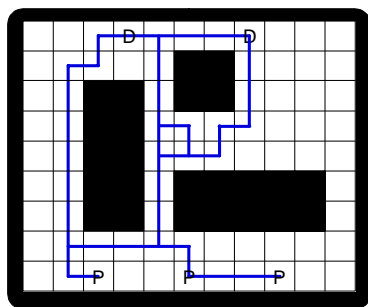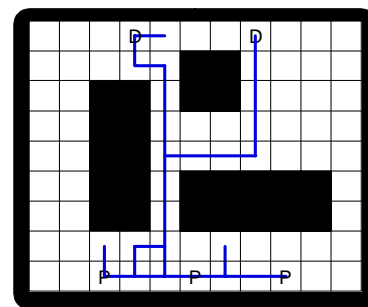

Fig. 2 Network with reactive approach

Fig. 3   Network with semi-dynamic approach

Fig. 4   Network with proposed approach