Preface

The Automated Guided Vehicle (AGV) is an automated guided cart that follows a guided path. This equipment is widely used in industrial fields and places of physical distribution. We have developed a new type of AGV that has additional functions such as following the motion of people and avoiding obstacles on the course it is traveling on. Therefore, it can work with service personnel even though there is no pre-determined guided path. In general, an AGV is a driverless transport system used for horizontal movement of materials. AGVs are especially used for the internal and external transport of materials. Moreover, vision or lasers can be used for determining the movement of an AGV.

Since their introduction in 1955, AGVs have found widespread industrial applications. AGVs are now found in all types of industries, with the only restrictions on their use mainly resulting from the dimensions of the goods to be transported or spatial considerations. Many applications of AGVs are technically feasible, but the purchase and implementation of such systems is usually based on economic considerations. The uses of AGVs can be divided into four main areas of application:

1) supply and disposal at storage and production areas;
2) production-integrated application of AGV trucks as assembly platforms;
3) retrieval, especially in wholesale trade; and
4) supply and disposal in special areas, such as hospitals and offices. In all of these settings.

AGVs have been found to reduce the damage to inventory, make production scheduling more flexible, and reduce staffing needs. But, as with any other major capital decision, implementation of these systems must be undertaken cautiously.

The AGVs were traditionally employed in manufacturing systems, but have recently extended their popularity to many other industrial applications, such as goods transportation in warehouses and container transshipment systems at container terminals. Industrial transportation systems using AGVs are used in warehouses and manufactures.

An AGV system is a fully automated industrial transport system that makes use of numerous AGVs. An AGV is a battery powered, computer controlled,

unmanned vehicle that is capable of transporting goods in an industrial environment. The AGVs are restricted to follow pre-determined paths, on which they navigate by using sensors and stationary beacons. Transports, which consist of picking up a load on a certain location and transporting it to a certain destination, are generated by an external system and have to be assigned to the AGVs. Traditionally, one computer system (central server) is in charge of numerous complex and time-consuming tasks such as routing, collision avoidance or deadlock avoidance.

The AGVs themselves have little autonomy. Although this planning is efficient, it lacks flexibility. In highly dynamic systems, where the situation changes frequently, problems are experienced. A new and innovative architecture has been developed that additional qualities, like flexibility and openness, to cope with the highly dynamic environments.

AGV usage is growing. One reason is that as manufacturers strive to become more competitive, they are adopting flexible manufacturing systems (FMS). These systems integrate automated material handling systems, robots, numerically controlled machine tools, and automated inspection stations. Flexible manufacturing systems offer high capital utilization and reduced direct labor costs. They also reduce work-in-process inventories and make it possible to work with shorter lead times. Because the systems are flexible, they are more responsive to changes in production requirements. These systems offer high product quality and increased productivity.

In this book different models and methods for optimizing AGV's path are developed. The chapters are useful for academic courses in graduate studies. The models are classified into single and multiple AGVs. Also, models under uncertain conditions including fuzzy and statistical approaches are proposed.

The book chapters are organized as follows. In the first chapter an overview of the models and methods of scheduling and routing problems for AGVs is presented. In chapter 2, material flow optimization using AGV is discussed. In chapter 3, a manufacturing system equipped with AGV is modeled using a nonlinear stochastic mathematical programming. In chapter 4, reliability of AGVs is considered and optimized. In chapter 5, path planning under uncertainty is explained and modeled. In chapter 6, AGV routing under stochastic run time is modeled by cross entropy concept. In chapter 7, expert system is designed for AGV optimal path planning considering multiple criteria. In chapter 8, intelligent

agent is developed for path planning of AGV. In chapter 9, delay optimization for multiple AGVs is developed and modeled. In chapter 10, Markovian modeling is proposed for evaluation of multiple AGV system. In chapter 11, producer behavior in an AGV equipped manufacturing system is analyzed. In the last chapter risk evaluation for AGVs in a manufacturing system is described.

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