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DISTRIBUTED OPTIMIZATION METHOD FOR SIMULTANEOUS PRODUCTION SCHEDULING AND TRANSPORTATION ROUTING IN SEMICONDUCTOR FABRICATION BAYS

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Abstract. *In this study, we propose a decentralized optimization method for production scheduling, transportation routing for AGVs and motion planning for material handling robots simultaneously. The system consists of a process agent that creates production schedule, AGV agents to generate collision-free routing for multiple AGVs, and a handling agent that determines motion planning for material handling system. Each agent repeats the information exchange and replanning until a feasible solution is derived. The effectiveness of the proposed method is confirmed by comparing the results of the proposed method and those of the conventional method. Experimental study demonstrates the feasibility of the proposed method.*
Keywords: FMS, Scheduling, Simultaneous optimization, Automated guided vehicle, Transportation, Experimental study

1. **Introduction.** For semiconductor industry, simultaneous optimization for scheduling and transportation is desired to ensure efficient manufacturing operations to reduce production and transportation costs in automated manufacturing systems with increasing highly intensified competition among worldwide production. It is necessary to improve production systems through reducing waiting time and increasing machine utilization. One of the predominant characteristics for semiconductor manufacturing systems is that the production system includes repetitive production process, AGVs transportation systems and several material handling systems transporting products between production machines and AGV systems which can be seen in flexible manufacturing systems (FMS).

Scheduling methods for FMS and transportation routing for automated guided vehicle (AGV) have been widely studied in previous FMS scheduling literature. Simulation based methods for scheduling a jobshop type FMS is studied by Tunali [1], mixed integer programming problem formulation with a heuristic procedure is proposed by Liu and MacCathy [2]. Petri-net based simulation for reentrant systems is studied by Odrey et al. [3]. One common approach for scheduling reentrant manufacturing systems is dispatching rule [4]. However, it is difficult to obtain near optimal solution by the dispatching heuristics. For AGV routing problems, genetic algorithm (GA) [5] or a distributed route planning method has been proposed by Nishi et al. [6]. The method can derive the routing to minimize total transportation time for AGVs by repeating the generation of routing for each AGV and data exchanging between the routing for each AGV.