Using Intelligent Vehicle Control Rules to Improve AMHS Performance in Highly Dynamic Manufacturing Environments

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USING INTELLIGENT VEHICLE CONTROL RULES TO IMPROVE AMHS PERFORMANCE IN HIGHLY DYNAMIC MANUFACTURING ENVIRONMENTS

THESIS

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To my parents,

inspired,

and inspiring.

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ABSTRACT

USING INTELLIGENT VEHICLE CONTROL RULES TO IMPROVE AMHS PERFORMANCE IN HIGHLY DYNAMIC MANUFACTURING ENVIRONMENTS

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Automated Material Handling System (AMHS) is crucial for a 300-mm manufacturing fab as to reduce ergonomic related problems, wafer contamination, and wafer damage. The main purpose of the AMHS is to optimize the fabrication process by reducing the manufacturing cycle time, and increasing equipment utilization. Researchers have experimented with dispatching rules in order to optimize the wafers delivery in the AMHS. However, many proposed dispatching rules cannot anticipate dynamic, and

frequent changes in the environment (i.e., vehicle breakdown, tool breakdown, changing demand, etc). Therefore, implementation of Intelligent Vehicle Control Rule (IVCR) can be a solution in solving this problem. The purpose of this thesis is to develop an IVCR useful in the design of vehicle-based AMHS that show statistically superior wafer delivery time (DT), retrieve time (RT), transport time (TT), and throughput than the static dispatching rules under tool breakdown, vehicle breakdown, number of moves, and load priority. The first contribution of this thesis is to simulate and compare all experimented rules (i.e. First-Encounter-First-Served [FEFS], modified Norman's algorithm [MODNORMAN], and IVCR) at different levels of detail. The second contribution is to explain the superiority of IVCR against other rules. A method for analyzing its performance and the influence of experimental factors are measured using the Design and Analysis of Experiments.