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www.elsevier.com/locate/ijpe

PII: S0925-5273(15)00075-4
DOI: http://dx.doi.org/10.1016/j.ijpe.2015.03.007
Reference: PROECO6026

To appear in: *Int. J. Production Economics*

Received date: 8 January 2014
Accepted date: 9 March 2015

Cite this article as: José A. Ventura, Subramanian Pazhani, Abraham Mendoza, Finding optimal dwell points for automated guided vehicles in general guide-path layouts, *Int. J. Production Economics,* http://dx.doi.org/10.1016/j.ijpe.2015.03.007

FINDING OPTIMAL DWELL POINTS FOR AUTOMATED GUIDED VEHICLES IN GENERAL GUIDE-PATH LAYOUTS

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January 4, 2014
Revised: October 11 30, 2014; February 23, 2015

Abstract

The dwell points for idle vehicles in an automated guided vehicle (AGV) system determine the response times for pick-up requests and thus affect the performance of automated manufacturing systems. In this article, we address the problem of optimally locating dwell points for a given number of AGVs in a general guide-path layout. Based on an optimality property, we propose new mixed integer linear programming (MILP) formulations for three versions of the problem: (i) minimizing the mean response time in the system, (ii) minimizing the maximum response time in the system, and (iii) minimizing the maximum response time in the system considering time restrictions on vehicle availability. Given that the computational time required to solve the MILP models significantly increases with the size of the guide-path network and number of available AGVs, we also develop a generic genetic algorithm (GA) that can be applied to all three versions of the problem. A computational study is carried out on the single-loop layout and two special cases of two-dimensional grid networks with the objectives of minimizing mean response time and minimizing the maximum response time. The results show that the proposed GA procedure can yield optimal or near optimal solutions in reasonable time.

Key words: Automated guided vehicle system, dwell point location, mixed integer linear programming model, genetic algorithm.

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