

# A Matheuristic for Scheduling Automated Guided Vehicles in a Multi-tenant Setting

Nitish Singh  
dr. Alp E. Akçay

Roel Nieuwenhuizen  
dr. Q. Vinh Dang

prof. dr. ir. I.J.B.F. Adan

## Introduction

*Brainport Industries Campus* in The Netherlands is a joint venture by *high-tech* suppliers to co-exist under the same production roof, use common infrastructure and be serviced by a common set of resources and to tackle operational uncertainties which plague companies operating under the omnipresent *siloed* model of working. Following the principles of *smart industry* or *industry 4.0*, the long-term goal is to have a *lights-out* factory floor which requires the control of operations at the shop floor without human interference with the use of automated guided vehicles (AGVs). However, added complexity due to the presence of multiple *tenants* translate to managing a heterogeneous fleet of AGVs with a diverse set of *capabilities, speeds, costs and charge levels*.



Figure 1: Heterogeneous AGV fleet

## Matheuristic

We introduce a scheduling matheuristic which makes use of Adaptive Large Neighborhood Search (ALNS) and a linear programming model to plan jobs on heterogeneous fleet of AGVs.

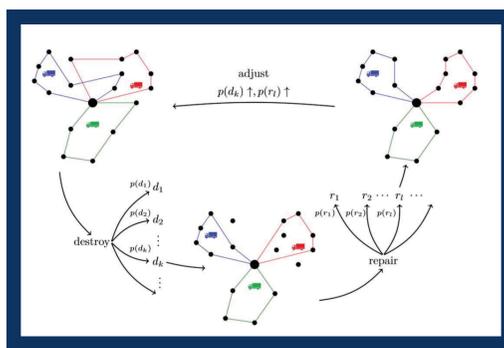


Figure 2: ALNS partially destroys and repairs a solution by choosing one method from a predefined pool of methods. The selected method is *rewarded* based on the new solution quality.

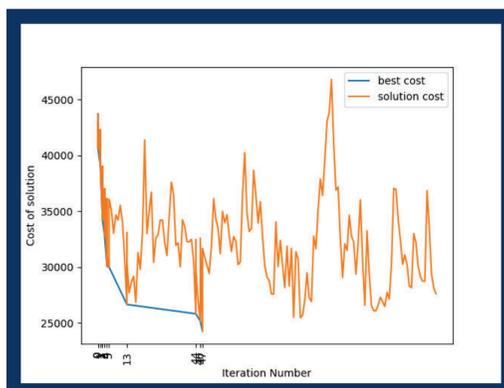


Figure 3: Solution exploration by matheuristic

## Results

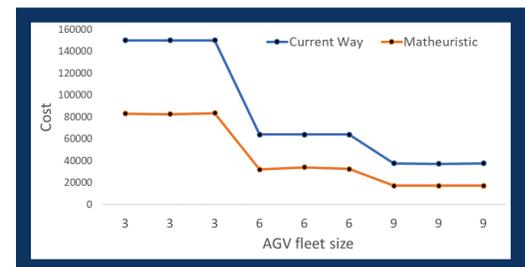


Figure 4: Cost analysis of company's current way vs matheuristic.

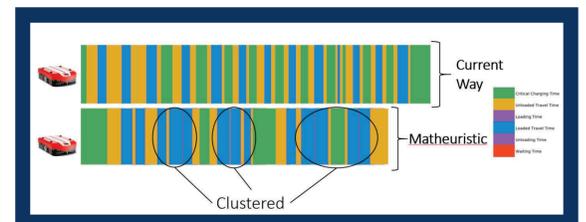


Figure 5: Comparison of schedules

## Conclusion

A matheuristic capable of making a good-quality feasible schedule was developed. Current methodology lends itself quite well to parallel fitness assessment tasks to realize an n-fold decrease in computation time. A schedule that minimizes a multi-objective function that considers variable request costs and AGV travel costs and their capabilities was constructed and shown to be, on average, 40% cost-efficient than company's current way of working on 162 test instances.