June 1, 2017

Contents

Chapter 1

Introduction

The problem of scheduling jobs and machines in flexible manufactoring systems has been addressed in scientific papers for a vast amount of complex variations. For this thesis a currently relatively unexplored set-up is considered: The scheduling of vehicles in a cyclic flexible manufactoring system. Flexible manufactoring systems are used in a wide range of fields and in occur in a lot of different variations. Additional machines at stages allow for a bypass of possible bottlenecks by increasing throughput capacity. A cyclic system is distinct from the standard version in that the depot is starting point and finish for all jobs in the system.

As automation is becoming increasingly relevant each day, the problem tackled here sets the vehicles carrying jobs between the machines to be automatically guided (AGVs). The approach considering vehicles without driver has been addressed for non cyclic problems in papers like insertpaperhere with special consideration of problem1 and insertpaperhere focusing on problem2. First considerations of the cyclic variant have been made by Blazewicz and Pawlak citationSVCFMS in which they introduced the idea of the vehicles staying in a steady cycle without any waiting time for possible unfinished jobs and the machine schedule itself being given, allowing for focus on the scheduling of the AGVs alone. The first of these premises eliminates the potential of collisions between the AGVs while the second reduces the amount of changeable variables. This thesis builds upon some of the findings of Blazewicz and Pawlak and implements a meta-heuristical approach by introducing a local search.

While the goal of the paper by Blazewicz and Pawlak was to solely minimize the amount of AGVs, here the approach is changed a bit: By fixating the amount of machines in an iteration of the meta-heuristic and simply focusing on the scheduling of a given amount of machines to minimize the makespan, a set of solutions for different amount of AGVs is received and a cost function depending on the amount of machines and the amount of overall delay in the for a given deadline can be used to select a final solution.

If the goal is to minimize the amount of AGVs for production without delay the cost function can be set to cost any constant c for each machine and Big-M per unit of delay.

Chapter 2

Formulation of the problem

2.1 Characteristics of Flexible Manufactoring Systems

2.2 Problems of the considered model

2.2.1 linearity

2.2.2 Issues of the cyclic model