

A SIMULATED ANNEALING PROCEDURE TO MINIMIZE TOTAL WEIGHTED TARDINESS ON A SINGLE MACHINE WITH UNEQUAL JOB RELEASE TIME, SEQUENCE DEPENDENT SETUP TIME, AND MACHINE DOWN TIME

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ABSTRACT

In this study, we explored a scheduling problem with machine down time, unequal job release time, and sequence dependent setup time to minimize the total weighted tardiness on a single machine. The ATCS rule (Apparent Tardiness Cost with Setup time Rule, Lee et al. 1997) was modified first and then presented with a simulated annealing procedure. Experimental results revealed that the performance of the new simulated annealing procedure outperformed the modified Lin's simulated annealing method (Lin and Ying, 2007) in the total weighted tardiness reduction.

Keywords: single machine, simulated annealing, dependent setup time, release time, machine down time.

1. INTRODUCTION

Tardiness is an important performance criterion in scheduling, especially for the customer satisfaction. Considerable research has been conducted to minimize tardiness related performances, like the total (weighted) tardiness and the sum of (weighted) earliness and tardiness. In this study, we aimed to minimize the total weighted tardiness for n jobs on a single machine with sequence dependent setup time, unequal job release time, and machine down time. Sequence dependent setup up time is a relative independent factor in real production. It can be neither ignored nor simply combined into the process time. Machine down time is another common factor to be observed in shop. Machine down time usually is caused by the preventive maintenance or machine deterioration.

The paper is organized as follows: Section 2 describes the studied problem. Section 3 lists some relevant research in literature. In section 4, we modify ATCS rule (Apparent Tardiness Cost with Setup Time Rule, Lee et al, 1997) and proposed MATCS rule (Modified Apparent Tardiness Cost with Setup Rule). The proposed simulated annealing procedure is presented in section 5. Section 6 is for experiment. It shows the results of the new dispatching rule and the new simulated annealing procedure. Finally, conclusions are given in section 7.

2. ASSUMPTIONS & PROBLEM DESCRIPTION

In this study, we explored a single machine scheduling problem with the following assumptions:

- Known job attributes: These attributes include job process time (p_i), job due date (d_i), job weight (w_i), job release time (r_i), and sequence dependent setup time (s_{ij}).
- Machine's ability to process only one job at a time.
- No job preemption.
- One machine breakdown that can occur in the generated scheduling horizon.

Our target was to schedule n jobs on the single machine to minimize total weighted tardiness with unequal job release time and machine down time.

3. LITERATURE REVIEW