A GENETIC ALGORITHM APPROACH FOR SOLVING DYNAMIC JOB SHOP SCHEDULING PROBLEM

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Degree of Master of Engineering

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Declaration

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text.

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The above candidate has carried out research for the Master's thesis under my supervision.

Signature of the Supervisor : ....
Dr.V.P.C. Dassanayake

Date : ....

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Abstract

Job Shop Scheduling Problem (JSSP) is a non-deterministic, polynomial-time (NP) hard combinatorial optimization problem. It is one of the most common problems in manufacturing due to its widespread application and the usability across the manufacturing industry. Due to the vast solution space the JSSP problem deals with, it is impossible to apply brute force search techniques to obtain an optimal solution. Indeed, it is not possible to obtain an optimal solution when the number of jobs and the machines increase. Numerous researches have been carried out studying many approaches to solve this problem. In this research, Genetic Algorithm (GA) which is another widely used nonlinear optimization technique has been used to propose an algorithm. A novel chromosome representation (indirect) with an encoding based on time is introduced in this research. The proposed solution is capable of handling multiple disruptions which are new job arrivals, sudden machine breakdown and unplanned machine maintenance. The proposed algorithm is tested against benchmark problems in Static JSSP and some developed scenarios to simulate Dynamic JSSP conditions. The results show that the proposed algorithm generates near optimal schedules for Static JSSP. This algorithm can be used as a planning tool by the planners. It is possible to simulate almost all the real-life scenarios using this algorithms and schedules can be generated satisfying the required conditions. The algorithm can be developed further by employing a local search algorithm which produced more precious, optimal schedules.

Keywords: Dynamic Job Shop Scheduling Problem, Genetic Algorithm, Disruptions in Job Shops

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List of Abbreviations

AI - Artificial Intelligence

ANN - Artificial Neural Network

BKS - Best-Known Solutions

BLSA - Bottleneck Local Search Agent

CR - Crossover Rate

CSV - Comma-Separated Values

DSPN - Distributed Problem Solving Networks

EDD - Earliest Due Date

FCFS - First Come, First Served

GA - Genetic Algorithm

GBML - Genetic Algorithm-based Machine Learning

JSSP - Job Shop Scheduling Problem

LSOA - Local Search Optimization Algorithm

MR - Mutation Rate

MUSA - Matchup Schedule Algorithm

PBX - Position Based Crossover

PSO - Particle Swarm Optimization

RP - Rescheduling Point

RS - Random Selection

RWS - Roulette Wheel Selection

SE - Scheduling Engine

SI - Swarm Intelligence

SPT - Shortest Processing Time

STU - Starting Time Unit

TS - Tournament Selection

VNS - Variable Neighbor Search

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