OPTIMISATION OF DYNAMIC AND STOCHASTIC PRODUCTION SCHEDULING SYSTEMS AFTER RANDOM DISRUPTIONS

by

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DEDICATION

This dissertation is dedicated to my mother (Mmatlala Annah Mapokgole).

ABSTRACT

The current business environments in many companies are characterized by markets facing tough competitions, from which customer requirements and expectations are becoming increasingly high in terms of quality, cost and delivery dates, etc. These emerging expectations are even getting stronger due to rapid development of new information and communication technologies that provide direct connections between companies and their clients. As a result, companies should have powerful control mechanisms at their disposal. To achieve this, companies rely on a number of functions including production scheduling. This function has always been present within companies, but today, it is facing increasing complexities because of the large number of jobs that must be executed simultaneously. Amongst many factors, it is time driven.

This study demonstrates that several disciplines can be married into one model (i.e. a unified model) to solve scheduling problems after disruptions, and clears the way for future multi-disciplinary research efforts. Scheduling problem is modeled as follows: Ito's stochastic differential rule is used to analyse the time evolution of random or stochastic processes. Multifactor productivity is used to unify various disruption factors. Theory of line balancing is also employed to determine the required number of resources to minimize bottleneck. Reliability: disruptions are considered to be equivalent to system failure. The failure rate of the system is translated to the reliability of the system mathematically. The probabilities of failure are used as indicators of disruptions, and the theory of reliability is then applied. Bernoulli's principle is also employed to relate pressure to production flow and aid in managing bottleneck situations.

Results indicate that the amount of resources needed after disruption depends on the nature of disruption, and that the scheduler should plan to increase number of facilities following a trend that is only predicted by the nature of disruptions. It is also shown that disruption of one type may not greatly affect productivity of a certain company layout, whilst similar disruptions can have devastating effect on another type. It is further concluded that impacts of disruption are dependent on the type of company layouts.

Keywords:

Production Scheduling, Reliability, Disruptions, Multifactor Productivity, Line Balancing, Ito's Stochastic Differential Rule, Bernoulli's theory, Company-Layouts.

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