

# بسم الله الرحمن الرحيم



HOSSAM MAGHRABY



# شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم



HOSSAM MAGHRABY



# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

### قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأقراص المدمجة قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



HOSSAM MAGHRABY



# بعض الوثائق الأصلية تالفة



HOSSAM MAGHRABY





بالرسالة صفحات

لم ترد بالأصل



HOSSAM MAGHRABY

B12992

**A NEW TYPE-SPECIFIC  
CONCURRENCY  
CONTROL ALGORITHM**

FACULTY OF ENGINEERING

ALEXANDRIA UNIVERSITY

A NEW TYPE-SPECIFIC CONCURRENCY  
CONTROL ALGORITHM

*A thesis submitted to the*

*Department of Computer Science and Automatic  
Control*

*in partial fulfillment of the requirements  
for the degree of*

*MASTER OF SCIENCE*

By :

Mohamed Abd El-Hafiz Mahfouz

supervised by

Prof. Dr . Salah Selim

Dr . Alaa El-Din Mukhtar

Dr . Nagwa El-Meky

Alexandria ,Sept. 1995

We certify that we have read this thesis and that in our opinion it is fully adequate  
in scope and quality ,as a dissertation for the degree of Master of Science

**Exam Committee :**

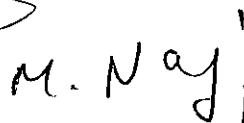
1. Prof. Dr. Abdul-Monem Yousif Belal

Department of Electric Engineering  
Cairo University



2. Prof. Dr. Magdy Nagy

Department of Computer Science and Automatic Control  
Alexandria University



3. Prof. Dr. M. Salah Seleim

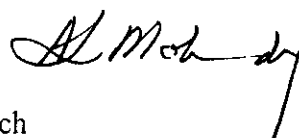
Department of Computer Science and Automatic Control  
Alexandria University



**For the Faculty of Council :**

Prof. Dr. Adel L. Mohammadain

Vice Dean for Graduate Studies and Research  
Faculty of Engineering-Alexandria University





### *Acknowledgments*

I greatly acknowledge the contribution of Dr. Nagwa El-Meky and Dr. Alaa El-Din via their experienced guidance and supervision, which had been the major incentive in the successful completion of this work. Their unfailing advice and genuine concern are greatly appreciated.

Special thanks are due to Prof. Dr. Salah Selim for his constant help and valuable advice.

I take advantage of this occasion to recognize and acknowledge the constant support accorded to me by the staff of my department, throughout my undergraduate and graduate years.

*Dedicated to my parents , my wife , my sister Mona  
and my lovely son Kareem*

## TABLE OF CONTENTS

	PAGE
ABSTRACT	iv
CHAPTER I - INTRODUCTION	1
1.1 BACKGROUND	1
1.2 TRANSACTION PROCESSING	2
1.3 CONCURRENCY CONTROL IN OBJECT-ORIENTED SYSTEMS	3
1.4 DATA APPROACH	4
1.4.1 INTERTYPE SYNCHRONIZATION	4
1.4.2 LOCAL CONCURRENCY CONTROL	6
1.4.2.1 COMMUTATIVITY-BASED MODELS	6
1.4.2.2 RECOVERABILITY-BASED MODELS	8
1.4.2.3 SERIAL DEPENDENCY-BASED MODELS	9
1.4.2.4 COMPARISON OF THE MODELS OF THE DATA APPROACH	10
1.5 TRANSACTION APPROACH	12
1.5.1 MULTILEVEL TRANSACTION MANAGEMENT	12
1.5.2 INTERTRANSACTION COMMUNICATION	13
CHAPTER II - THE PROPOSED ALGORITHM	
2.1 INTRODUCTION	15
2.2 RELATED WORK	16
2.3 A CONCURRENCY CONTROL AND COMMIT PROTOCOL	17
2.3.1 THE PROPOSED CONCURRENCY CONTROL ALGORITHM	18
2.3.2 COMMITTING PSEUDO COMMITTED TRANSACTION	20
2.3.3 PROVING CORRECTNESS OF THE ALGORITHM	21



### CHAPTER III -THE MEAN VALUE MODEL FOR THE PERFORMANCE ANALYSIS OF THE STUDIED TYPE- SPECIFIC CONCURRENCY CONTROL ALGORITHMS

3.1 INTRODUCTION	23
3.2 THE MODELING APPROACH	24
3.2.2 MODEL PRESENTATION	25
3.2.3 BASIC EQUATIONS	30
3.2.4 SOLUTION TECHNIQUE	33
3.3 ANALYSIS OF ALGORITHM I :	34
(COMMUTATIVITY BASED ALGORITHM)	
3.4 ANALYSIS OF ALGORITHM II :	39
(RECOVERABILITY BASED ALGORITHM)	
3.5 ANALYSIS OF ALGORITHM III :	49
(SERIAL DEPENDENCY BASED ALGORITHM )	
3.6 MODELING HARDWARE RESOURCE CONTENTION	55
3.7 CONCLUSIONS	56

### CHAPTER IV - SIMULATION STUDY

4.1 INTRODUCTION	57
4.2 SIMULATION PROCESS	58
4.2.1 THE PROPOSED SIMULATION MODEL	58
4.2.2 EXPERIMENTAL INFORMATION	59
4.2.3 PERFORMANCE SETTINGS	60
4.2.4 PERFORMANCE METRICS	60
4.2.5 IMPLEMENTATION OF THE SIMULATION MODEL	61
4.2.6 START-UP POLICIES	61
4.2.7 DETERMINATION OF THE SIMULATOR	62
SAMPLE SIZE	
4.3 VERIFICATION AND VALIDATION	64
4.3.1 VERIFICATION OF THE SIMULATION MODEL	64
4.3.2 VALIDATION OF THE SIMULATION MODEL	64
4.4 VALIDATION OF THE ANALYTICAL MODEL	75
4.5 CONCLUSIONS	79

## CHAPTER V - PARAMETRIC STUDIES

5.1 INTRODUCTION	80
5.2 EFFECT OF VARYING THE MULTIPROGRAMMING LEVEL	84
5.3 EFFECT OF VARYING THE DATABASE SIZE	93
5.4 EFFECT OF VARYING THE TRANSACTION SIZE	96
5.5 EFFECT OF VARYING THE DEGREE OF SERIAL DEPENDENCY	98
5.6 EFFECT OF USING THE RESULTS OF OPERATIONS	101
5.7 EFFECT OF HARDWARE RESOURCE CONTENTION	105

## CHAPTER VI - SUMMARY AND CONCLUSIONS

6.1 SUMMARY	110
6.2 CONCLUSIONS ABOUT THE PROPOSED ALGORITHM	111
6.3 CONCLUSIONS ABOUT THE ANALYTICAL MODEL	111
6.4 RECOMMENDATIONS FOR FUTURE EXTENSIONS	112

APPENDIX A - EXAMPLE OF TYPE-SPECIFIC CONCURRENCY CONTROL APPLIED TO A SIMPLE INVENTORY SYSTEM	113
---	-----

REFERENCES	123
------------	-----

## ARABIC SUMMARY

## ABSTRACT

The work of this thesis has been mainly motivated by the advantages of using the serial dependency as a conflict relation which is weaker than the commutativity relation.. We propose a new type-specific concurrency control algorithm which uses serial dependency as a conflict relation. Unlike the pessimistic concurrency control algorithms in literature, which use a symmetric serial dependency relation, the proposed algorithm uses an asymmetric serial dependency relation. It distinguishes symmetric and asymmetric conflicts and uses this information to improve the level of concurrency .

Performance analysis of algorithms that use the serial dependency relation are not presented in the literature. Consequently , one of the objectives of this study , was to propose an approximate analytical model to obtain bounds for the performance of the proposed algorithm relative to the related algorithms proposed in literature.

An analytical model was formulated to obtain bounds for the performance of the studied algorithms. The proposed analytical model is based on the mean value approach.

A simulation model was constructed, verified and validated. Then, the approximations of the proposed analytical model were validated by comparing the results obtained from the analytical solution to those obtained from the corresponding simulation runs .

Finally, several parametric studies were conducted using the validated analytical model to compare the performance of the proposed algorithm to the related type-specific algorithms



CHAPTER I

INTRODUCTION