SYSTEMATIC METHODOLOGY FOR ESTIMATION OF SYSTEM RELIABILITY AT DESIGN PHASE

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I declare that this thesis entitled "*Systematic Methodology For Estimation of System Reliability at Design Phase*" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 21st November 2013

To my beloved parent, wife, children, family, and friends…

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ABSTRACT

In software development lifecycle, correctness of system functionality as well as system quality is crucial at the design phase. During this phase, modelling and estimation of system reliability have become more complicated because of the non-systematic methodology for reliability estimation. Complications are due to the strong coupling between reliability design and reliability estimation models, which has resulted in the growing scale of estimated systems. The current reliability estimation methodologies are often executed in isolated models and do not provide expressive reliability design model in terms of reliability requirements, thus leading to inaccurate estimation. Besides that, estimation based on assumptions of these isolation models is prone to human error. Thus, an integrated model comprising new reliability design and reliability estimation models using a systematic methodology for reliability estimation is proposed. The reliability design model is capable of expressing the required reliability requirements whereas the reliability estimation model improves the current estimation accuracy. The modelling and estimation results were evaluated and compared with the existing models and methodologies namely, Core Scenario Model (CSM), Performance Context Model (PCM) and Kernel Language for Performance and Reliability Analysis (KLAPER). The findings showed that the systematic methodology had increased the expressiveness of the reliability design model by 67% and 99.24% for the estimation accuracy. This integrated model using systematic methodology for reliability estimation system would enable developers to systematically estimate system reliability by overcoming the complexity of executed models.

ABSTRAK

Di dalam kitaran pembangunan perisian, kesahihan kefungsian dan kualiti sistem adalah sangat penting semasa fasa reka bentuk. Semasa fasa ini, permodelan dan penganggaran kebolehpercayaan sistem menjadi semakin rumit disebabkan oleh metodologi yang tidak sistematik untuk penganggaran kebolehpercayaan. Komplikasi-komplikasi ini disebabkan oleh ikatan yang kuat di antara model reka bentuk kebolehpercayaan dan model penganggaran kebolehpercayaan, di mana telah menghasilkan skala yang berkembang untuk sistem yang dianggarkan. Metodologi-metodologi penganggaran kebolehpercayaan yang sedia ada dilaksanakan secara model terasing dan tidak menawarkan model reka bentuk kebolehpercayaan yang ekspresif di mana akan menjurus kepada anggaran yang kurang tepat. Selain itu, penganggaran berasaskan tanggapan bagi model terasing terdedah kepada kesilapan manusia. Oleh itu, model bersepadu yang mengandungi model baharu untuk reka bentuk kebolehpercayaan dan penganggaran kebolehpercayaan menggunakan metodologi yang sistematik untuk penganggaran kebolehpercayaan dicadangkan. Model reka bentuk kebolehpercayaan mampu untuk menunjukkan keperluan kebolehpercayaan yang diperlukan manakala model penganggaran kebolehpercayaan memperbaiki ketepatan penganggaran. Hasil keputusan kajian untuk permodelan dan penganggaran telah dinilai dan dibandingkan dengan model-model dan metodologi-metodologi yang sedia ada iaitu, *Core Scenario Model (CSM), Performance Context Model (PCM)* dan *Kernel Language for Performance and Reliability Analysis (KLAPER)*. Penemuan kajian menunjukkan metodologi yang sistematik bagi kadar peratusan ekspresif untuk model reka bentuk kebolehpercayaan telah ditingkatkan kepada 67% dan 99.24% untuk ketepatan penganggaran. Model bersepadu yang menggunakan metodologi yang sistematik untuk menganggar kebolehpercayaan sistem akan membolehkan pembangun-pembangun sistem menganggar kebolehpercayaan sistem secara sistematik dengan mengatasi kerumitan model yang dilaksanakan.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xiv
	LIST OF FIGURES	xvii
	LIST OF ABBREVIATIONS	xx
	LIST OF APPENDICES	xxiii
1	**INTRODUCTION**	
	1.1 Introduction	1
	1.2 Challenges in Reliability Design Modelling	5
	1.3 Challenges in Reliability Parameter Estimation	7
	1.4 Challenges in Reliability Estimation Model	9
	1.5 Motivation	11
	1.6 Problem Statement	11
	1.7 Research Objectives	14
	1.8 Scopes of the research	14
	1.9 Thesis organization	15

2	**REVIEW OF MODEL BASED RELIABILITY ESTIMATION**		
	2.1	Introduction	16
	2.2	Software Quality	16
		2.2.1 Software Quality Model	17
		2.2.2 Software Reliability Engineering (SRE)	18
		2.2.3 Software System for Reliability	20
	2.3	System Reliability Estimation Methodology	22
	2.4	Modelling Approach For Reliability Model	24
		2.4.1 Benefits of quality analysis during design level	24
		2.4.2 UML Profiles Based Modeling	25
		2.4.3 MOF-Based Modeling	28
		2.4.3.1 Comparative Evaluation Framework	31
		2.4.3.2 Results and Discussion	34
		2.4.4 Analytical-Based Modeling	38
		2.4.5 Comparison For Modeling Approach	39
	2.5	Reliability Parameter Estimation model	40
		2.5.1 Model-based Approach	40
		2.5.2 Execution Environment	42
		2.5.3 Discussion	42
	2.6	Reliability Estimation Model	44
		2.6.1 Black-Box Approach	45
		2.6.2 White-Box Approach	45
		2.6.3 Model Representation	47
		2.6.4 Discussion	49
	2.7	Summary and Concluding Remarks	49
3	**RESEARCH METHODOLOGY**		
	3.1	Introduction	51
	3.2	Research Framework	51
	3.3	Research Process	54
		3.3.1 Development of the Reliability Model	56
		3.3.2 Development of the Reliability Estimation Model	57

3.3.3 Development of the Reliability Estimation Methodology 58
3.3.4 Evaluation of the proposed model and methodology 58
3.4 Case Studies 61
3.4.1 Robotic Wheel Chair System 62
3.4.2 Building Security System 63
3.4.3 Benchmark System 64
3.4.4 Weapon Control System 65
3.4.5 Justification and Classification of the Case Studies 66
3.5 Software and Systems Process Engineering Metamodel (SPEM) 67
3.6 Goal, Questions, Metrics Framework 68
3.7 Summary 69

4 THE PROPOSED RELIABILITY MODEL WITH INTEGRATED RESOURCES AND TASKS

4.1 Introduction 70
4.2 The Methodology for Reliability Design Model Development 71
4.2.1 Identifying the Reliability Context 72
4.2.2 Initiating Model Construction 73
4.2.3 Developing the Metamodel/Model 74
4.2.4 Defining the Formal Definition 74
4.2.5 Developing the Model Transformation Framework 75
4.3 The Proposed Reliability Design Model 76
4.3.1 Metamodel Elements 77
4.3.1.1 Scenario Elements 78
4.3.1.2 Failure Behaviour Elements 80
4.3.1.3 Resource Elements 81
4.3.2 Concrete Syntax 82
4.3.2.1 Model Usage 83

4.3.3 Behavioral View 83
4.3.3.1 Call Sequence 85
4.3.3.2 Failure Behaviour view 86
4.3.3.3 Resource view 88
4.4 The Formal Semantics 89
4.4.1 Metamodel, Metamodel Realization and Model Types 91
4.4.2 Metamodel Semantic 93
4.4.2.1 Behaviour 95
4.4.3 Model Semantic 96
4.4.3.1 Operation State 97
4.4.3.2 System Configuration State 98
4.4.3.3 Logical Linear Sequence 99
4.4.3.4 Logical Failure Sequence 99
4.4.4 Model Conformance 100
4.5 PerFAM-Based Transformation Framework 101
4.5.1 From UML to PerFAM Model 103
4.5.2 From PerFAM Model to Anlysis Model 107
4.6 Case Study Evaluation 109
4.6.1 UML Scenario Model 110
4.6.2 PerFAM Model 111
4.6.3 Analysis Model 114
4.6.4 Result Discussion 116
4.7 Discussion 117
4.8 Summary 119

5 THE PROPOSED RELIABILITY ESTIMATION MODEL AND THE EXTENDED RELIABILITY DESIGN MODEL
5.1 Introduction 120
5.2 The Methodology for Reliability Estimation Model Development 121
5.2.1 Identifying Domain Concepts 121
5.2.2 Constructing Formal Definition 122
5.2.3 Developing Method For Reliability 122

5.2.4 Executing Model Validation 123
5.3 The Proposed Estimation Model 123
5.3.1 A Formal Definition 124
5.3.2 Diagram Compositional 125
5.3.3 Method for Reliability Estimation for RDG 126
5.3.3.1 Sequential Structure 127
5.3.3.2 Branch Structure 128
5.3.4 Model Validation 129
5.3.4.1 Experiment Setting 130
5.3.4.2 Results of Acceptable Degree of Estimation 134
5.3.4.3 Results for Accuracy Degree Estimation 136
5.3.4.4 Discussion 138
5.4 Summary 140

6 THE PROPOSED RELIABILITY PARAMETER SPECIFICATIONS MODEL FROM THE EXTENDED PERFAM MODEL

6.1 Introduction 142
6.2 PerFAM Model Extension for Reliability Parameter Specification 142
6.2.1 Identify Reliability Parameter 144
6.2.2 Deriving Reliability Parameter 144
6.2.3 Formulating Reliability Parameter 145
6.3 Details of Reliability Parameters Specification 147
6.3.1 General Parameters 148
6.3.2 Activity 149
6.3.3 Resource 150
6.3.4 System Scenario 153
6.3.5 Discussion 155
6.4 Summary 155

7 A METHODOLOGY FOR MODEL-BASED SYSTEM RELIABIILTY ESTIMATION

7.1 Introduction 157

7.2 Overview of The Proposed Methodology 157

7.2.1 Establish the Context 159

7.2.2 Create the Design Model 160

7.2.3 Create Reliability Model 161

7.2.4 Estimate Reliability Parameters Value 162

7.2.5 Estimate System Reliability 163

7.2.6 Conduct Sensitivity Analysis 164

7.2.7 Design Decision for Model Refinement 166

7.3 Application to the case study 167

7.3.1 Establish the Context and Create the Design Model 167

7.3.2 Create the PerFAM Model 170

7.3.3 Estimate the Reliability Parameters 172

7.3.3.1 Activity 172

7.3.3.2 Resource 174

7.3.4 Estimate the System Reliability 175

7.3.5 Conducting The Sensitivity Analysis 179

7.3.6 Design Decision and Model Refinement 183

7.3.7 Discussion 184

7.4 Summary 185

8 DESIGN QUALITY ASSESSMENT AND EVALUATION

8.1 Introduction 186

8.2 Evaluation Strategy 186

8.3 Design Model Expressiveness 188

8.3.1 Results and Discussion 190

8.4 Design Model Consistency 193

8.4.1 Results and Discussion 196

8.5 Methodologies Evaluation 199

8.6 Summary 202

9 CONCLUSION

9.1 Introduction 203

9.2 Achievement of the study 203

9.3 Contributions 205

9.4 Future Works 208

REFERENCES **210**

APPENDICES A-D 223-233