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**PRACTICAL BUFFER SIZING TECHNIQUES UNDER DRUM-
BUFFER-ROPE:
DEVELOPMENT OF A MODEL AND FUZZY LOGIC
IMPLEMENTATION**

**A thesis presented in partial
fulfilment of the requirements
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In Memory of Louis Borman
(1913 - 1994)

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Abstract

A production buffer is a queue of work waiting in front of a manufacturing work-station for processing. The buffer protects the work-station utilisation from variability in the flow of work from feeding work-stations. Effective buffer management is critical to the smooth flow of work and the maintenance of a predictable output rate.

An effective buffer management policy must address three questions that characterise the buffer management problem (BMP):

1. What objective function to use?
2. Where to locate buffers?
3. What is the appropriate buffer sizes?

Despite being simple to describe, to date few practical heuristics for buffer management have been developed by researchers. The approach of researchers is to place a buffer of work in front of every work-station, whatever the objective function is being used. The answer to the third issue is then typically found by applying a combinational optimisation technique. The practical benefits of locating buffers throughout a manufacturing facility and the use of complex combinatorial optimisation methods to solve over-stylised problems are questionable. As a consequence of this “academic” approach, research results are rarely used by practitioners who still rely on intuition to solve the BMP.

The production application of the Theory of Constraints, Drum-Buffer-Rope (DBR), provides exact answers to the first and second questions. Throughput (or output rate) is adopted as the objective function. Buffers locations are limited in front of the constraint work-station, in assembly areas using constraint processed parts and in the shipping area.

Buffer size is a open issue in a DBR implementation and directly influences the time-based competitiveness of a manufacturing facility. Too small a buffer can result in the constraint

work-station being starved and due date promises missed; too large a buffer can result in a longer than necessary lead times.

Buffer sizing advice is vague and non-specific and relies heavily on managerial understanding and experience. This can reduce the effectiveness of DBR implementations and greatly increases the implementation lead time as intuition rarely guarantees the best possible outcome for a given set of circumstances.

In today's competitive and increasing globalised economy, a structured approach that sizes buffers in an effective and implementable manner is likely to yield significant benefits over a traditional DBR implementation. This thesis explores the subject of practical buffer sizing in a DBR environment.

A fuzzy logic approach is proposed and used to size buffers in a simulated DBR environment. The effectiveness of the technique is assessed and contrasted with a simple and commonly used buffer sizing heuristic.

Simulation results demonstrate that fuzzy logic effectively sizes buffers and is likely to provide a satisfactory answer to the third question of the BMP: what is the appropriate buffer size.

Table of Contents

ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
1. INTRODUCTION	1
1.1 Research Background	2
1.2 Manufacturing System Behaviour	4
1.3 Effective Scheduling	5
1.3.1 Just-In-Time (JIT) Systems	6
1.3.2 Drum-Buffer-Rope (DBR) Systems	7
1.4 Buffer Management Problem (BMP)	9
1.5 Purpose of the Research	10
1.6 Methodology	11
1.7 Thesis Structure	12
2. BUFFER MANAGEMENT SUBJECT REVIEW	14
2.1 Introduction	15
2.2 Production Buffers	16
2.3 The Buffer Management Problem	17
2.3.1 The Objective Function	18
2.3.2 Formulation of the Buffer Management Problem	19
2.3.3 Generic Design Issues	21
2.4 Solution Approaches	22
	vi

2.4.1 Analytical Solutions	23
2.4.2 Enumerative Solutions	24
2.4.3 Simulation Solutions	25
2.4.4 Design of Experiments (DOE) Solutions	27
2.4.5 Search Method Solutions	28
2.4.6 Heuristic Solutions	29
2.5 Criticism of the Optimal Buffer Concept	30
2.6 Drum-Buffer-Rope	31
2.6.1 System Characteristics and Dynamics	31
2.6.2 Drum-Buffer-Rope (DBR)	32
2.6.3 Buffer Management and Continuous Improvement	37
2.7 Discussion and Research Agenda	39
2.8 Summary	41
3. FUZZY LOGIC SUBJECT REVIEW	41
3.1 Introduction	42
3.2 Fuzziness	43
3.2.1 Fuzzy and Boolean Sets	46
3.3 Fuzzy Modelling Process	48
3.3.1 Fuzzification	49
3.3.2 Fuzzy Inference System	54
3.3.3 Defuzzification	57
3.4 Fuzzy Logic Applied to the Management of Production Buffers	58

3.4.1 Fuzzy Systems are Easier to Understand	58
3.4.2 Fuzzy Input Variables	59
3.4.3 Analytical Intractability	61
3.4.4 Room to Grow	62
4. FUZZY BUFFER SIZING MODEL IMPLEMENTATION	63
4.1 Introduction	64
4.2 Selection of Input and Output Variables	64
4.2.1 Output Variables	65
4.2.2 Input Variables	65
4.3 Fuzzification	68
4.3.1 Fuzzy Term Sets	68
4.3.2 Membership Function Shape	72
4.4 Fuzzy Inference System	73
4.4.1 Fuzzy Rules	73
4.4.2 Fuzzy Implication and Aggregation	77
4.5 Defuzzification	77
4.6 The Fuzzy Buffer Sizing Model and a Worked Example	78
5. SIMULATION METHODOLOGY	80
5.1 Introduction	81
5.2 Simulation as a Solution Approach	81
5.3 Manufacturing Model	82
5.4 Modelling Variability	85

5.4.1 Distribution Type	86
5.4.2 Central Tendency of Processing Time Distribution	90
5.4.3 Processing Time Variation	91
5.4.4 Proposed Processing Time Distribution	93
5.4.5 Example Processing Time Distributions	97
5.5 Comparison of Buffer Sizing Techniques	99
5.5.1 Buffer Effectiveness and the Appropriate Buffer Size	103
5.5.2 Practical vs Statistical Significance	105
6. SIMULATION MODEL IMPLEMENTATION	108
6.1 Introduction	109
6.2 Fuzzy Logic Research Hypothesis	109
6.3 Model Specification	109
6.3.1 Product Type and Work-Order Generation	109
6.3.2 Modal Processing Times	112
6.3.3 Manufacturing Model Assumptions	115
6.4 Computer Implementation	116
6.5 Model Verification	118
6.6 Methodological Issues	120
6.6.1 Auto-correlation	120
6.6.2 Steady State Conditions	122
6.6.3 Replications	124
6.6.4 Data Collection Techniques	124
6.6.5 Data Collection in this Research	125

6.7 Experimental Design	133
6.7.1 Pre-experimental Design Experimentation	134
6.7.2 Pre-Experimental Design Experimentation: MRP Driven Job-Shop	136
7. EXPERIMENTATION AND ANALYSIS	
7.1 Introduction	138
7.2 Buffer Sizing and Effectiveness	138
7.2.1 Estimated Buffer Size	139
7.2.2 Appropriate Buffer Size	140
7.2.3 Buffer Effectiveness	141
7.3 Discussion	143
7.4 Practical Significance	144
7.5 Summary	146
8. FUTURE WORK	147
8.1 Introduction	148
8.2 Improvements to the Fuzzy Logic Model	148
8.2.1 Estimation of Protective Capacity	148
8.2.2 Membership Function Shapes	149
8.2.3 Optimisation of Rule Confidences	149
8.2.4 Implication and Defuzzification Strategies	150
8.2.5 Tuning the Fuzzy Membership Functions	150
8.2.6 Testing and Implementation	152
8.3 Methodological Issues	152

8.3.1 Further Simplification of the Manufacturing Model	152
8.3.2 Testing the Validity of Manufacturing Model Simplifications	153
8.3.3 Processing Time Distributions	154
8.3.4 Delay Time Order Statistic	154
8.3.5 Practical Significance	155
8.4 The Role of Protective Capacity	155
8.5 Buffer Management Technologies	156
8.5.1 Constraint Focused Quality Improvement	156
8.5.2 Expediting Tardy Work-Orders	157
8.5.3 The “How To” of Buffer Management	157
8.6 Quality in Research	159
9. CONCLUSIONS	160
9.1 Introduction	161
9.2 The Buffer Management Problem (BMP)	161
9.3 Results	162
9.4 Publications from this Research	163
9.5 Contribution of this Research	164

REFERENCES	165
APPENDICES	174
APPENDIX A: TRIANGULAR PROCESSING TIME DISTRIBUTION CALCULATIONS	175
APPENDIX B: VERIFICATION OF INPUT PROBABILITY DISTRIBUTIONS	177
APPENDIX C: SIMULATION CODE	180

List of Figures

Figure Number

2.1	Example Manufacturing Facility	33
2.2	Buffer Profile	37
2.3	The Three Regions of a Buffer	38
3.1	Balancing Significance with Precision	44
3.2	Graded Membership Function for <i>Excellent</i> Due Date Performance	45
3.3	Boolean Membership Function for <i>Excellent</i> Due Date Performance	47
3.4	Fuzzy Term Set Due Date Performance	50
3.5	Domain and Overlap of Fuzzy Term Set Due Date Performance	51
3.6	Triangular Membership Function	52
3.7	Sigmoid Membership Function	53
3.8	Gaussian Membership Function	53
4.1	Mean Protective Capacity (MPC) Term Set	69
4.2	The Effect of Up-stream Variability (UV) Term Set	69
4.3	The Appropriate Buffer Size (BS) Term Set	70
4.4	Effect of MPC on Buffer Size	76
4.5	Effect of UV on Buffer Size	76
4.6	The Fuzzy Buffer Sizing Model	78

4.7	Worked Example of Fuzzy Buffer Sizing Solution (MPC=30% and $cv = 0.07$)	79
5.1	A Full DBR Implementation	83
5.2	A Simplified DBR Implementation	84
5.3	A Typical Lognormal Distribution	88
5.4	Gamma Distribution ($\mu = 10; \sigma = 1$)	88
5.5	Gamma Distribution ($\mu = 10; \sigma = 3$)	89
5.6	Gamma Distribution ($\mu = 10; \sigma = 5$)	89
5.7	Effect of Changing cv on the Mode of the Gamma Distribution	92
5.8	Specifying Processing Time Distributions	97
5.9	Triangular (7.68, 10, 12.62) Distribution	98
5.10	Triangular (7.68, 10, 17.17) Distribution	98
5.11	Time Series Plot of 100 Delay Times	100
5.12	Histogram of Randomly Sampled Delay Times	105
6.1	Computer Simulation Logic	118
6.2	Auto-correlation Function of Mean Cycle Time (MPC = 30% and $cv = 0.07$)	122
6.3	Data Collection	125
6.4	Mean Utilisation of Work-station One	127
6.5	Mean Utilisation of Work-station Two	127
6.6	Mean Utilisation of Work-station Three	128
6.7	Mean Utilisation of Work-station Four	128

6.8	Mean Utilisation of Work-station Five	129
6.9	Mean Delay Time	129
6.10	Mean Utilisation of Work-station Three	130
6.11	Mean Utilisation of Work-station Four	130
6.12	Mean Utilisation of Work-station Five	131
6.13	Mean Utilisation of Work-station Six	131
6.14	Mean Cycle-Time	132
6.15	Effect of Mean Protective Capacity On 95% Delay Time Quartile	135
6.16	Effect of cv on 95% Delay Time Quartile	136
7.1	Buffer Effectiveness of the Fuzzy Logic Model	142
7.2	Buffer Effectiveness of Umble's Heuristic	143
8.1	Buffer Size is too Small	151
B.1	Processing Times	179

List of Tables

Table Number		
1.1	Competitive Dimensions	3
2.1	Objective Functions Used in the BMP	18
3.1	Expert Interpretation of the Due Date Metric	45
4.1	Fuzzy Term Set Overlap	72
5.1	Mathematical Properties of the Gamma Distribution	90
5.2	Mathematical Properties of the Triangular Distribution	94
6.1	Input Distributions	110
6.2	Nomenclature	111
6.3	Example Final Assembly Schedule	112
6.4	Routing and Processing Information by Product Type	114
6.5	Relative Precision Achieved with 10 Replications	133
6.6	3x3 Experimental Design	134
7.1	Estimated Buffer Sizes for Umble's Heuristic and Fuzzy Logic Model	140
7.2	Appropriate (95% Delay Time Quartile) Buffer Size	141
7.3	Buffer Effectiveness	142
7.4	Summary Statistics	143
7.5	Simulation Results	146
B.1	Tally Sheet for Product Type	177

