

ABSTRACT

DEVELOPMENT OF MULTIOBJECTIVE OPTIMIZATION PROCEDURES FOR SEISMIC DESIGN OF STEEL MOMENT FRAME STRUCTURES

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Design of seismic-resistant civil structural systems necessitates a balanced minimization of two general competing objectives: the present capital investment and the future seismic risk. Many of the existing seismic design optimization procedures use single objective functions of either the traditional minimum material usage (weight or cost) or the recent minimum expected life cycle cost criterion while imposing constraints from relevant code specifications as well as additional seismic performance concerns. The resulting single optimized structural design may not always perform satisfactorily in terms of other important but conflicting merit objectives; the designer's individual risk-acceptance level is not conveniently integrated into the design process.

Genetic algorithm based automated seismic design procedures are developed in the present study for member sizing optimization of code-compliant regular plane steel special moment resisting frame structures with simultaneous as well as separate treatment of multiple objective functions that reflect steel material usage, initial expenses, degree of design complexity, seismic structural performance indices, and lifetime seismic damage cost, respectively. A wide distribution of valid alternative designs is obtained that establishes optimized tradeoff among all relevant conflicting merit objectives. Therefore, structural engineers have much broader view of the entire optimized design space and thus more flexibility to select, through an explicit tradeoff decision-making process with valuable engineering experiences, the most desirable cost-effective design solution that balances different merit aspects in a preferred manner.

To Mother, Father, and Baoxia

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TABLE OF CONTENTS

CHAPTER 1	
INTRODUCTION	1
1.1 Background	1
1.2 Motivation	3
1.3 Objectives and scope	5
1.4 Organization	7
CHAPTER 2	
CODE PROVISIONS FOR SEISMIC DESIGN OF STEEL STRUCTURES	9
2.1 2000 NEHRP equivalent lateral force procedure	9
2.1.1 Seismic base shear	10
2.1.2 Vertical distribution of seismic forces	11
2.1.3 Determination of design story drifts	11
2.2 AISC-LRFD seismic steel design specifications	13
2.2.1 Load combinations	13
2.2.2 Effects of seismic loads	14
2.2.3 Member strength checking	14
2.2.4 Strong-column-weak-beam criterion	15
2.2.5 Width-thickness ratio limits	17
CHAPTER 3	
MODELING AND PERFORMANCE EVALUATION PROCEDURES FOR STEEL MOMENT FRAME STRUCTURES	18
3.1 Modeling of steel moment frames for seismic loads	18
3.1.1 Overview	18
3.1.2 Nonlinear steel members	19
3.1.3 Panel zones	20
3.1.4 Beam-to-column connections	21
3.1.5 P-delta effects due to interior gravity loads	22
3.1.6 Other modeling issues	23
3.2 Frame modeling for the present study	24
3.2.1 An example steel moment frame	24
3.2.2 Modeling considerations	25
3.3 Seismic performance evaluation procedures	26
3.3.1 Overview	26
3.3.2 Static pushover analysis	28
<i>Lateral force distributions</i>	28
<i>Basic theory</i>	29
<i>Application issues</i>	31
3.4 Seismicity for the present study	32
CHAPTER 4	
GENETIC ALGORITHMS FOR MULTIOBJECTIVE STRUCTURAL OPTIMIZATION	40

4.1	Traditional structural optimization algorithms.....	40
4.1.1	Overview	40
4.1.2	Application to multiobjective optimization	41
4.2	Genetic algorithms	43
4.2.1	Overview	43
4.2.2	Multiobjective optimization via genetic algorithms	45
	<i>General remarks</i>	45
	<i>Fitness assignment strategies</i>	46
	<i>Constraint-handling strategies</i>	50
	<i>Elitist strategies</i>	52
4.3	Genetic algorithm for the present study	52
4.4	Structural design optimization via genetic algorithms	53
4.4.1	Overview	53
4.4.2	Genetic algorithm based multiobjective structural design	55
CHAPTER 5		
	CONSTRUCTION-CONSCIOUS MINIMUM WEIGHT SEISMIC DESIGN	58
5.1	Introduction	58
5.2	Problem statement	61
5.3	Numerical examples	62
5.3.1	Analysis of optimized tradeoff structural designs.....	62
5.3.2	Comparison of optimized designs with different period calculation	64
5.4	Summary	65
CHAPTER 6		
	MULTIOBJECTIVE OPTIMIZATION FOR PERFORMANCE-BASED SEISMIC DESIGN	73
6.1	Introduction	73
6.2	A multiobjective design optimization framework.....	77
6.2.1	Steel material weight.....	78
6.2.2	Number of different steel section types	78
6.2.3	Seismic structural performance indices	79
	<i>Peak roof drift ratio</i>	79
	<i>Peak interstory drift ratio</i>	80
	<i>System displacement ductility</i>	80
	<i>Other performance indices</i>	81
6.3	Numerical Examples	81
6.3.1	Primary and secondary merit measures.....	81
6.3.2	Distribution of optimized designs with respect to primary merit measures.....	82
6.3.3	Distribution of optimized designs with respect to secondary merit measures	83
6.3.4	Minimum material weight designs with varied section type numbers.....	85
6.3.5	Optimized designs with the same number of different section types.....	87
6.3.6	Optimized designs with close material weights	87
6.3.7	Time history analysis of two alternative designs	88
6.4	Summary	89
CHAPTER 7		
	LIFE CYCLE COST ORIENTED SEISMIC DESIGN OPTIMIZATION:	

A MULTIOBJECTIVE APPROACH	102
7.1 Introduction	103
7.2 A multiobjective design optimization procedure	108
7.2.1 General formulation	108
7.2.2 Calculation of lifetime seismic damage cost.....	109
<i>Analytical Formula</i>	109
<i>Definition of damage states</i>	110
7.2.3 Treatment of randomness and uncertainty	112
<i>Use of mean value of limit state probabilities</i>	112
<i>Use of percentile value of limit state probabilities</i>	114
7.3 Numerical examples	121
7.3.1 Minimum life cycle cost design considering degree of design complexity	122
<i>Optimization results and tradeoff analysis</i>	122
<i>Effects of confidence levels on minimum life cycle cost designs</i>	125
<i>Performance evaluation of globally minimum life cycle cost designs</i>	126
7.3.2 Design optimization with three objective functions.....	127
<i>Tradeoff among three objective functions</i>	127
<i>Minimum life cycle cost designs with varied degrees of design complexity</i>	130
<i>Effects of confidence levels on minimum life cycle cost designs</i>	131
<i>Minimized initial cost design with damage cost constraint</i>	132
7.4 Summary	133
CHAPTER 8	
CONCLUSIONS AND FUTURE WORK	183
8.1 Conclusions	183
8.2 Future work	185
APPENDIX A	
CALCULATION OF MEMBER STRENGTH DEMANDS IN AISC-LRFD	187
APPENDIX B	
DATABASE OF STANDARD STEEL WIDE-FLANGE SECTION TYPES	190
APPENDIX C	
DERIVATION OF ANALYTICAL FORMULATION FOR EXPECTED LIFETIME SEISMIC DAMAGE COST	196
APPENDIX D	
COST FUNCTIONS FOR SEISMIC DAMAGE LIMIT STATES	200
APPENDIX E	
PROBABILISTIC BASIS FOR SAC/FEMA GUIDELINES	203
APPENDIX F	
MATLAB PROGRAM LISTING	207

LIST OF REFERENCES	251
VITA	259

LIST OF TABLES

Table 2.1	Width-thickness ratio limits (AISC 1994, 1997, 2000)	17
Table 3.1	Coefficients for $R - \mu - T$ relationship (Nassar and Krawinkler 1991)	33
Table 3.2	Target response spectra values (Somerville et al. 1997)	33
Table 3.3	Characteristics of SAC 50/50 set of Los Angeles ground motion records	34
Table 3.4	Characteristics of SAC 2/50 set of Los Angeles ground motion records	35
Table 5.1	Optimized tradeoff design solutions using rationally calculated periods	67
Table 5.2	Optimized tradeoff design solutions using empirical periods	67
Table 6.1	Member sizes for minimum weight designs with varied section type numbers	91
Table 6.2	Merit measures of minimum weight designs with varied section type numbers	92
Table 6.3	Member sizes for designs of steel material weight close to 150 k-lbs with lowest maximum interstory drift demands and varied section type numbers	93
Table 6.4	Merit measures for designs of steel material weight close to 150 k-lbs with lowest maximum interstory drift demands and varied section type numbers	94
Table 7.1	Structural performance levels (FEMA-273 1997)	137
Table 7.2	Damage state-related performance levels (Kang and Wen 2000)	137
Table 7.3	Descriptive building performance levels (FEMA-350 2000)	138
Table 7.4	Structural performance levels (FEMA-350 2000)	138
Table 7.5	The present drift ratio limits of seven damage states	139
Table 7.6	Confidence level calculation parameters for mid-rise steel SMRF by static pushover analysis with global interstory drift ratios as the performance index	139
Table 7.7	Sets of drift ratio limits associated with varied confidence levels for limit state probabilities	140
Table 7.8	Minimum life cycle cost designs of varied section type numbers with CL-40 set of drift ratio limits and use of sum of initial cost and damage cost as one objective function	141
Table 7.9	Minimum life cycle cost designs of varied section type numbers with CL-50 set of drift ratio limits and use of sum of initial cost and damage cost as one objective function	142
Table 7.10	Minimum life cycle cost designs of varied section type numbers with CL-60 set of drift ratio limits and use of sum of initial cost and damage cost as one objective function	143
Table 7.11	Minimum life cycle cost designs of varied section type numbers with CL-70 set of drift ratio limits and use of sum of initial cost and damage cost as one objective function	144
Table 7.12	Minimum life cycle cost designs of varied section type numbers with CL-80 set of drift ratio limits and use of sum of initial cost and damage cost as one objective function	145

Table 7.13	Minimum life cycle cost designs of varied section type numbers with CL-90 set of drift ratio limits and use of sum of initial cost and damage cost as one objective function	146
Table 7.14	Minimum life cycle cost designs of the same small number of section types and varied sets of drift ratio limits and use of sum of initial cost and damage cost as one objective function	147
Table 7.15	Minimum life cycle cost designs of the same medium number of section types and varied sets of drift ratio limits and use of sum of initial cost and damage cost as one objective function	148
Table 7.16	Globally minimum life cycle cost designs with varied sets of drift ratio limits and use of sum of initial cost and damage cost as one objective function	149
Table 7.17	Minimum life cycle cost designs of varied section type number with CL-40 set of drift ratio limits and use of initial cost and damage cost as separate objective functions	150
Table 7.18	Minimum life cycle cost designs of varied section type number with CL-50 set of drift ratio limits and use of initial cost and damage cost as separate objective functions	151
Table 7.19	Minimum life cycle cost designs of varied section type number with CL-60 set of drift ratio limits and use of initial cost and damage cost as separate objective functions	152
Table 7.20	Minimum life cycle cost designs of varied section type number with CL-70 set of drift ratio limits and use of initial cost and damage cost as separate objective functions.....	153
Table 7.21	Minimum life cycle cost designs of varied section type number with CL-80 set of drift ratio limits and use of initial cost and damage cost as separate objective functions	154
Table 7.22	Minimum life cycle cost designs of varied section type number with CL-90 set of drift ratio limits and use of initial cost and damage cost as separate objective functions	155
Table 7.23	Designs of five section types with similar calculated damage cost using varied sets of drift ratio limits	156

LIST OF FIGURES

Figure 3.1	Plan view and elevation of an example steel building	36
Figure 3.2	Member linking patterns assumed in the example steel frame	36
Figure 3.3	Illustrative sketch of the static pushover analysis	37
Figure 3.4	Acceleration response spectra at two hazard levels	38
Figure 3.5	50-year and annual probabilities of exceedance for SAC spectral accelerations.....	39
Figure 4.1	Population ranking based on nondominated sorting	56
Figure 4.2	Crowding distance calculation	56
Figure 4.3	String representation of the example SMRF design in the present GA	57
Figure 5.1	Generation-wise evolution of the number of total optimized tradeoff designs using rationally calculated fundamental periods	68
Figure 5.2	Generation-wise evolution of the number of new optimized tradeoff designs using rationally calculated fundamental periods	68
Figure 5.3	Generation-wise evolution of optimized tradeoff designs using rationally calculated fundamental periods	69
Figure 5.4	Sketch of optimized tradeoff designs using rationally calculated fundamental periods	69
Figure 5.5	Generation-wise evolution of the number of total optimized tradeoff designs using empirical fundamental periods	70
Figure 5.6	Generation-wise evolution of the number of new optimized tradeoff designs using empirical fundamental periods	70
Figure 5.7	Generation-wise evolution of optimized tradeoff designs using empirical fundamental periods	71
Figure 5.8	Sketch of optimized tradeoff designs using empirical fundamental periods.....	71
Figure 5.9	Comparison of optimized tradeoff designs obtained using different fundamental period calculations.....	72
Figure 6.1	Flowchart of the automated design procedure	95
Figure 6.2	Distribution of all optimized tradeoff designs at the 400 th generation with respect to each primary merit measure.....	96
Figure 6.3	Distribution of all optimized tradeoff designs at the 400 th generation with respect to each secondary merit measure.....	97
Figure 6.4	Drift uniformity ratios of all optimized tradeoff designs at the 400 th generation	98
Figure 6.5	Minimum weight designs with varied degrees of design complexity at the 400 th generation.....	98
Figure 6.6	Optimized tradeoff designs with five section types at the 400 th generation.....	99
Figure 6.7	Comparison of designs of steel material weight close to 150 k-lbs with lowest maximum interstory drift demands and varied section type numbers.....	99
Figure 6.8	Nominal design drift ratio profiles for two alternative designs	100
Figure 6.9	Normalized static pushover curves for two alternative designs.....	100

Figure 6.10	Peak interstory drift demand profiles at different hazard levels for two alternative designs by time history analysis	101
Figure 6.11	Maximum interstory drift demands at different hazard levels for two alternative designs by time history analysis	101
Figure 7.1	Flowchart of the proposed GA-based multiobjective optimization procedure for designing steel SMRF structures considering life cycle costs	157
Figure 7.2	Incorporation of randomness/uncertainty by increasing exceedance probability ..	158
Figure 7.3	Incorporation of randomness/uncertainty by increasing drift ratio demands.....	159
Figure 7.4	Incorporation of randomness/uncertainty by decreasing drift ratio limits that define damage states	159
Figure 7.5	Confidence level curve for Immediate Occupancy drift ratio limit	160
Figure 7.6	Confidence level curve for Collapse Prevention drift ratio limit	160
Figure 7.7	Comparison of varied confidence level dependent sets of drift ratio limits.....	161
Figure 7.8	Varied calculated damage costs for the same SMRF design using varied confidence level dependent sets of drift ratio limits	161
Figure 7.9	Generational evolution of optimized designs using varied confidence level dependent sets of drift ratio limits.....	162
Figure 7.10	Nominal design drift ratio profiles for globally minimum life cycle cost designs obtained using varied confidence level dependent sets of drift ratio limits	163
Figure 7.11	Normalized static pushover curves for globally minimum life cycle cost designs obtained using varied confidence level dependent sets of drift ratio limits	163
Figure 7.12	Initial costs for globally minimum life cycle cost designs obtained using varied confidence level dependent sets of drift ratio limits.....	164
Figure 7.13	Actual system yield levels for globally minimum life cycle cost designs obtained using varied confidence level dependent sets of drift ratio limits	164
Figure 7.14	Peak interstory drift demand profiles at different hazard levels by time history analysis for globally minimum life cycle cost designs obtained using varied confidence level dependent sets of drift ratio limits.....	165
Figure 7.15	Maximum peak interstory drift demands at different hazard levels by time history analysis for globally minimum life cycle cost designs obtained using varied confidence level dependent sets of drift ratio limits.....	167
Figure 7.16	Median 50-year probabilistic performance curves by time history analysis for globally minimum life cycle cost designs obtained using varied sets of drift ratio limits.....	168
Figure 7.17	Median annual probabilistic performance curves by time history analysis for globally minimum life cycle cost designs obtained using varied sets of drift ratio limits.....	168
Figure 7.18	3D tradeoff among objective functions for all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits	169
Figure 7.19	2D projection of tradeoff among objective functions for all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits.....	169
Figure 7.20	Tradeoff among initial cost and damage cost for each section type number	

	using all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits.....	170
Figure 7.21	Monetary costs as a function of system yield coefficient for all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits.....	171
Figure 7.22	Monetary costs as a function of system yield coefficient for each section type number using all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits	172
Figure 7.23	Monetary costs as a function of design drift ratio for all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits.....	173
Figure 7.24	Costs as a function of design drift ratio for each section type number using all 398 optimized designs at the 200 th generation with CL-70 set of drift ratio limits.....	174
Figure 7.25	Comparison of minimum life cycle cost designs at the 200 th generation.....	175
Figure 7.26	Sketches of minimum life cycle cost designs of varied section type numbers at the 200 th generation with CL-70 set of drift ratio limits	176
Figure 7.27	Sketches for design solutions of five section types with similar calculated damage cost obtained using varied confidence level dependent sets of drift ratio limits.....	176
Figure 7.28	Nominal design drift ratio profiles for design solutions of five section types of five section types with similar calculated damage cost obtained using varied confidence level dependent sets of drift ratio limits.....	177
Figure 7.29	Normalized static pushover curves for design solutions of five section types with similar calculated damage cost obtained using varied confidence level dependent sets of drift ratio limits	177
Figure 7.30	Initial costs for design solutions of five section types with similar calculated damage cost obtained using varied confidence level dependent sets of drift ratio limits.....	178
Figure 7.31	Actual system yield levels for design solutions of five section types with similar calculated damage cost obtained using varied confidence level dependent sets of drift ratio limits.....	178
Figure 7.32	Peak interstory drift demand profiles at different hazard levels by time history analysis for design solutions of five section types with similar calculated damage cost	179
Figure 7.33	Maximum peak interstory drift demands at different hazard levels by time history analysis for design solutions of five section types with similar calculated damage cost.....	181
Figure 7.34	Median 50-year probabilistic performance curves by time history analysis for design solutions of five section types with similar calculated damage cost	182
Figure 7.35	Median annual probabilistic performance curves by time history analysis for design solutions of five section types with similar calculated damage cost.....	182