

USE OF INCREMENTAL DYNAMIC ANALYSIS TO ASSESS THE
PERFORMANCE OF STEEL MOMENT-RESISTING FRAMES WITH FLUID
VISCOUS DAMPERS

by

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(ABSTRACT)

This thesis presents the results of a study that uses Incremental Dynamic Analysis to assess the seismic performance of steel moment-resisting frames with fluid viscous dampers subjected to earthquake ground motions. The study systematically investigated the effects of linear and nonlinear dampers on the response of steel moment-resisting frames to earthquakes that varied in intensity and type. Both near-field and far-field motions were considered. Two different types of nonlinear dampers were investigated; one had a hardening and the other had a softening force-velocity relationship. The nonlinear dampers were calibrated to the linear dampers so that there was a basis of comparison. Maximum damper displacement is one of the parameters of the calibration, and it was varied to investigate its effect on structural response. Several nonlinear inelastic time history analyses were performed to obtain responses, such as peak base shear, peak interstory drift, or residual displacement index, which were plotted versus earthquake intensity to create individual IDA curves. Sets of related IDA curves provide a useful summary of the structural behavior for a wide range of variables. IDA curves for the tests with different damping types are presented. The results show that for both near-field and far-field ground motions the nonlinear dampers with a hardening force-velocity relationship are best suited to reduce undesirable drifts and residual displacements; however, these reductions come at the cost of high base shear forces.

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Table of Contents

1. Introduction	1
1.1 Background and Motivation	1
1.2 Purpose and Objectives	2
1.3 Overview of Thesis	3
2. Background	4
2.1 Background of Fluid Viscous Damping	4
2.2 Analytical Models	8
2.2.1 Linear Fluid Viscous Dampers	10
2.2.2 Nonlinear Fluid Viscous Dampers	11
2.3 Previous Research	12
2.3.1 Nonlinear Fluid Viscous Dampers	12
2.3.2 Damping of Structures Subjected to Near-Field Motions	15
2.4 Incremental Dynamic Analysis	16
2.5 Damage Indices	20
2.5.1 Park and Ang Damage Index	20
2.5.2 Peak Interstory Drift Angle	22
2.5.3 Peak Base Shear	23
2.6 Residual Displacements	23
3. Models and Procedures	26
3.1 Introduction	26
3.2 Description of Model	26
3.2.1 Introduction to LA 9-Story Building	26
3.2.2 Beams	30
3.2.3 Columns	35
3.2.4 Panel Zones	37
3.2.5 Dynamic Properties of LA 9-Story Building	42
3.2.6 Dampers	43
3.2.6.1 Force-Velocity Relationship	43
3.2.6.2 Nonlinear Damping Coefficient	44
3.2.7 P-Delta Effects	48
3.3 Procedure	49
3.3.1 IDA Procedure	49
3.3.2 Response Measures	50
3.3.2.1 Park and Ang Damage Index	50
3.3.2.2 Peak Interstory Drift Ratio and Peak Base Shear	51
3.3.3 Residual Displacements	52
3.3.4 Ground Motions	54
3.3.4.1 Scaled Ground Motions Records	54
3.3.4.2 Scaling the Ground Motions	60
4. Results and Discussion	64
4.1 Introduction	64
4.2 Critical Damping Ratio	64
4.3 Damping Exponent	76

4.3.1 Peak Base Shear IDA Plots	77
4.3.2 Peak Interstory Drift Ratio IDA Plots	78
4.3.3 Percent Reduction IDA Plots	80
4.3.4 Discussion of Individual IDA Curve Behavior	84
4.4 Multi-Record IDA Curves	85
4.5 Damage Index IDA Curves	90
4.6 Residual Displacements	92
4.6.1 Displacement Time History Plots	92
4.6.2 Residual Displacement IDA Plots	95
4.7 Relating Dispersion to Residual Displacements	103
4.8 Dampers with Yielding Braces	105
4.8.1 Peak Base Shear and IDR for Structure with Yielding Braces	107
4.8.2 Residual Displacements for Structure with Yielding Braces	109
5. Conclusions	113
5.1 Summary	113
5.2 Conclusions	114
5.2.1 Damper Type	114
5.2.2 Residual Displacements	115
5.2.3 Dispersion	116
5.2.4 Relating Residual Displacements and Dispersion	116
5.2.5 Calibration Parameter	116
5.2.6 Comparison of Damage Indices	118
5.3 Limitations of Study	118
5.4 Recommendations for Further Research	118
References	121
Appendix A. Verification of Perform	125
Appendix B. IDA Plots	140
Vita	206

List of Figures

Figure 2.1: Fluid Viscous Damper	5
Figure 2.2 (a-b): Force-Displacement Relationship for Viscous Fluid Damper	7
Figure 2.3: Maxwell Model	9
Figure 2.4: Force-Velocity Relationships for Fluid Viscous Dampers	12
Figure 2.5: IDA Curve for Single Ground Motion Record	18
Figure 2.6: Multi-Record IDA Curve	18
Figure 3.1: Plan View of LA 9-Story Building	27
Figure 3.2: LA 9-Story MRF (N-S Elevation)	28
Figure 3.3: Typical Beam Element	30
Figure 3.4: Moment-Rotation Relationship for an Inelastic Hinge	31
Figure 3.5 (a-b): Stress-Strain and Moment-Curvature Relationships	32
Figure 3.6: Cantilever Beam Analysis	33
Figure 3.7: Moment Diagram for Cantilever Beam	33
Figure 3.8: Curvature Diagram for Cantilever Beam	34
Figure 3.9: Typical Column Element	36
Figure 3.10: P-M Interaction Diagram for Column Hinges	37
Figure 3.11: Krawinkler Model for the Beam-to-Column Connections	38
Figure 3.12: Shear Force-Shear Strain Relationship for Panel Zone	39
Figure 3.13: Moment-Rotation Relationship for Panel Zone Spring	41
Figure 3.14: Force-Velocity Relationship for Nonlinear Damper in Perform	43
Figure 3.15: Force-Displacement for Linear and Nonlinear Fluid Dampers	44
Figure 3.16: Force-Velocity for Dampers with Different Calibration Constants	47
Figure 3.17: Example of Base Shear in a Structure	52
Figure 3.18: Time History Plot with Residual Displacement	53
Figure 3.19: Time History Plot with Residual Displacement Measure	53
Figure 3.20: LA01-Imperial Valley	56
Figure 3.21: LA07-Landers	56
Figure 3.22: LA10-Landers	56
Figure 3.23: LA11-Loma Prieta	57
Figure 3.24: LA13-Northridge	57
Figure 3.25: LA17-Northridge	57
Figure 3.26: NF01-Tabas	58
Figure 3.27: NF07-C. Mendocino	58
Figure 3.28: NF09-Erizingan	58
Figure 3.29: NF11-Landers	59
Figure 3.30: NF13-Northridge	59
Figure 3.31: NF19-Kobe	59
Figure 3.32 (a-b): Unscaled Response Spectrum for LA and NF Ground Motions	61
Figure 3.33 (a-b): Scaled Response Spectrum for LA and NF Ground Motions	63
Figure 4.1: IDA $\alpha=1.0$, 5-20% Crit Damp, LA11	65
Figure 4.2: Close-up of IDA Curves for $\alpha=1.0$, 5-20% Crit Damp, LA11	66
Figure 4.3: Total Force vs. Amp for 10%, 15%, and 20% Damped System	66
Figure 4.4 (a-c): Force vs. Amp for (a) 10%, (b) 15%, and (c) 20% Damp	67

Figure 4.5 (a-c): T-H Plots (a) 10%, (b) 15%, and (c) 20% Damp, Amp=30 in.	68
Figure 4.6 (a-c): T-H Plots (a) 10%, (b) 15%, and (c) 20% Damp, Amp=100 in.	70
Figure 4.7: Inelastic Hinges for 20% Crit Damp Subjected to LA11 at 0.3g	72
Figure 4.8 Inelastic Hinges for 20% Crit Damp Subjected to LA11 at 0.7g	73
Figure 4.9 (a-b): Percent Reduction IDA $\alpha=1.0$, LA11	74
Figure 4.10 (a-b): IDA $\alpha=1.0$, 5-20% Crit Damp, NF07	75
Figure 4.11: Close-up of IDA $\alpha=1.0$, 5-20% Crit Damp, NF07	75
Figure 4.12 (a-b): Percent Reduction IDA $\alpha=1.0$, NF07	76
Figure 4.13 (a-b): Base Shear IDA LA11 Motion 10% (a) 20% (b) Crit Damp	78
Figure 4.14 (a-b): Base Shear IDA NF07 Motion 10% (a) 20% (b) Crit Damp	78
Figure 4.15 (a-b): IDR IDA LA11 Motion 10% (a) 20% (b) Crit Damp	79
Figure 4.16 (a-b): IDR IDA NF07 Motion 10% (a) 20% (b) Crit Damp	79
Figure 4.17 (a-b): Percent Reductions LA11 w/ 10% Crit Damp	81
Figure 4.18 (a-b): Percent Reductions LA11 w/ 20% Crit Damp	81
Figure 4.19: Force-Velocity Relationship for Dampers	83
Figure 4.20 (a-b): Multi-Record IDA $\alpha=0.5$ at 1% drift 20% damp NF Motions	86
Figure 4.21(a-b): Multi-Record IDA $\alpha=1.0$ 20% damp NF Motions	86
Figure 4.22 (a-b): Multi-Record IDA $\alpha=1.5$ at 1% drift 20% damp NF Motions	87
Figure 4.23 (a-b): Standard Deviation IDA 20% Damp for NF Motions	88
Figure 4.24 (a-b): Close-Up Standard Deviation IDA 20% Damp for NF Motions	89
Figure 4.25 (a-b): DI IDA 10% (a) and 20% (b) Crit Damp w/ $a=1.5$	90
Figure 4.26: DI IDA 10% (a) and 20% (b) w/ $\alpha=0.5, 1.0, \text{ and } 1.5$ for NF07	91
Figure 4.27 (a-d): Disp T-H Plots NF13 at 0.1, 0.2, 0.3, & 0.4 g	93
Figure 4.28 (a-d): Disp T-H Plots NF13 at 0.5, 0.9, 1.3, & 1.7 g	94
Figure 4.29: Residual Displacement IDA 20% Crit Damp NF01	95
Figure 4.30: Close-Up Residual Displacement IDA 20% Crit Damp NF01	96
Figure 4.31: RD- IDA 20% Crit Damp LA17	97
Figure 4.32: RD- IDA 20% Crit Damp LA11	99
Figure 4.33: RD- IDA 20% Crit Damp LA01	100
Figure 4.34 (a-c): Disp T-H Plots $\alpha=0.5$ 20% Crit Damp LA01 0.9, 1.3, & 1.7 g	101
Figure 4.35 (a-c): Disp T-H Plots $\alpha=0.5$ 20% Crit Damp LA01 0.9, 1.3, & 1.7 g	102
Figure 4.36: Standard Deviation of IDR vs. Residual Displacement	104
Figure 4.37: Brace Force IDA 10% Crit Damp NF01 and NF11	105
Figure 4.38: Single-Story Damping Frame w/ Inelastic Spring	106
Figure 4.39 (a-b): IDA Plots $\alpha=1.5$ at 1% Drift 20% Crit Damp NF01	107
Figure 4.40 (a-b): IDA Plots $\alpha=1.0$ 20% Crit Damp NF01	108
Figure 4.41(a-b): IDA Plots $\alpha=0.5$ at 1% drift 20% Crit Damp NF01	109
Figure 4.42 (a-c): RD-IDA LA01 $\alpha=0.5, 1.0, \text{ \& } 1.5$ 20% Crit Damp	111
Figure A.1: Pulse Time History	126
Figure A.2: Results of a Linear Elastic Time History Analysis	127
Figure A.3: Linear SDOF Frame w/ Fluid Viscous Damper	127
Figure A.4: Disp T-H SDOF Frame w/ Damper $\alpha=0.5$	129
Figure A.5: Disp T-H SDOF Frame w/ Damper $\alpha =0.7$	129
Figure A.6: Disp T-H SDOF Frame w/ Damper $\alpha =0.9$	129
Figure A.7: Disp T-H SDOF Frame w/ Damper $\alpha =1.0$	129

Figure A.8: Disp T-H SDOF Frame w/ Damper $\alpha = 1.1$	130
Figure A.9: Disp T-H SDOF Frame w/ Damper $\alpha = 1.3$	130
Figure A.10: Disp T-H SDOF Frame w/ Damper $\alpha = 1.5$	130
Figure A.11: Nonlinear Pushover Curves	137
Figure A.12: Roof Disp vs. Time from Nonlinear Inelastic T-H Analysis	139
Figure B.1 (a-b): IDA 5-20% Crit Damp LA01	142
Figure B.2 (a-b): IDA 5-20% Crit Damp LA07	142
Figure B.3 (a-b): IDA 5-20% Crit Damp LA10	143
Figure B.4 (a-b): IDA 5-20% Crit Damp LA10	143
Figure B.5 (a-b): IDA 5-20% Crit Damp LA13	143
Figure B.6 (a-b): IDA 5-20% Crit Damp LA17	144
Figure B.7 (a-b): IDA 5-20% Crit Damp NF01	144
Figure B.8 (a-b): IDA 5-20% Crit Damp NF07	144
Figure B.9 (a-b): IDA 5-20% Crit Damp NF09	145
Figure B.10 (a-b): IDA 5-20% Crit Damp NF11	145
Figure B.11 (a-b): IDA 5-20% Crit Damp NF13	145
Figure B.12 (a-b): IDA 5-20% Crit Damp NF19	146
Figure B.13: Close-Up of Base Shear IDA LA01	147
Figure B.14: Close-Up of Base Shear IDA LA07	147
Figure B.15: Close-Up of Base Shear IDA LA10	147
Figure B.16: Close-Up of Base Shear IDA LA11	148
Figure B.17: Close-Up of Base Shear IDA LA13	148
Figure B.18: Close-Up of Base Shear IDA LA17	148
Figure B.19: Close-Up of Base Shear IDA NF01	149
Figure B.20: Close-Up of Base Shear IDA NF07	149
Figure B.21: Close-Up of Base Shear IDA NF09	149
Figure B.22: Close-Up of Base Shear IDA NF11	150
Figure B.23: Close-Up of Base Shear IDA NF13	150
Figure B.24: Close-Up of Base Shear IDA NF19	150
Figure B.25 (a-b): Percent Reduction IDA 5-20% Crit Damp LA01	151
Figure B.26 (a-b): Percent Reduction IDA 5-20% Crit Damp LA07	151
Figure B.27 (a-b): Percent Reduction IDA 5-20% Crit Damp LA10	152
Figure B.28 (a-b): Percent Reduction IDA 5-20% Crit Damp LA11	152
Figure B.29 (a-b): Percent Reduction IDA 5-20% Crit Damp LA13	152
Figure B.30 (a-b): Percent Reduction IDA 5-20% Crit Damp LA17	153
Figure B.31 (a-b): Percent Reduction IDA 5-20% Crit Damp NF01	153
Figure B.32 (a-b): Percent Reduction IDA 5-20% Crit Damp NF07	153
Figure B.33 (a-b): Percent Reduction IDA 5-20% Crit Damp NF09	154
Figure B.34 (a-b): Percent Reduction IDA 5-20% Crit Damp NF11	154
Figure B.35 (a-b): Percent Reduction IDA 5-20% Crit Damp NF13	154
Figure B.36 (a-b): Percent Reduction IDA 5-20% Crit Damp NF19	155
Figure B.37 (a-b): LA Motions IDA 10% Crit Damp $\alpha=0.5$ at 1% Drift	156
Figure B.38 (a-b): LA Motions IDA 10% Crit Damp $\alpha=0.5$ at 5% Drift	156
Figure B.39 (a-b): LA Motions IDA 10% Crit Damp $\alpha=1.0$	157
Figure B.40 (a-b): LA Motions IDA 10% Crit Damp $\alpha=1.5$ at 1% Drift	157
Figure B.41 (a-b): LA Motions IDA 10% Crit Damp $\alpha=1.5$ at 5% Drift	157

Figure B.42 (a-b): NF Motions IDA 10% Crit Damp $\alpha=0.5$ at 1% Drift	158
Figure B.43 (a-b): NF Motions IDA 10% Crit Damp $\alpha=0.5$ at 5% Drift	158
Figure B.44 (a-b): NF Motions IDA 10% Crit Damp $\alpha=1.0$	159
Figure B.45 (a-b): NF Motions IDA 10% Crit Damp $\alpha=1.5$ at 1% Drift	159
Figure B.46 (a-b): NF Motions IDA 10% Crit Damp $\alpha=1.5$ at 5% Drift	159
Figure B.47 (a-b): LA Motions IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift	160
Figure B.48 (a-b): LA Motions IDA 20% Crit Damp $\alpha=0.5$ at 5% Drift	160
Figure B.49 (a-b): LA Motions IDA 20% Crit Damp $\alpha=1.0$	161
Figure B.50 (a-b): LA Motions IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift	161
Figure B.51 (a-b): LA Motions IDA 20% Crit Damp $\alpha=1.5$ at 5% Drift	161
Figure B.52 (a-b): NF Motions IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift	162
Figure B.53 (a-b): NF Motions IDA 20% Crit Damp $\alpha=0.5$ at 5% Drift	162
Figure B.54 (a-b): NF Motions IDA 20% Crit Damp $\alpha=1.0$	163
Figure B.55 (a-b): NF Motions IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift	163
Figure B.56 (a-b): NF Motions IDA 20% Crit Damp $\alpha=1.5$ at 5% Drift	163
Figure B.57 (a-b): Stan Dev IDA 10% Crit Damp for LA Motions	164
Figure B.58 (a-b): Stan Dev IDA 10% Crit Damp for NF Motions	164
Figure B.59 (a-b): Stan Dev IDA 20% Crit Damp for LA Motions	165
Figure B.60 (a-b): Stan Dev IDA 20% Crit Damp for NF Motions	165
Figure B.61 (a-b): IDA 10% Crit Damp Structure Subjected to LA01	166
Figure B.62 (a-b): IDA 10% Crit Damp Structure Subjected to LA07	166
Figure B.63 (a-b): IDA 10% Crit Damp Structure Subjected to LA10	167
Figure B.64 (a-b): IDA 10% Crit Damp Structure Subjected to LA11	167
Figure B.65 (a-b): IDA 10% Crit Damp Structure Subjected to LA13	167
Figure B.66 (a-b): IDA 10% Crit Damp Structure Subjected to LA17	168
Figure B.67 (a-b): IDA 10% Crit Damp Structure Subjected to NF01	168
Figure B.68 (a-b): IDA 10% Crit Damp Structure Subjected to NF07	168
Figure B.69 (a-b): IDA 10% Crit Damp Structure Subjected to NF09	169
Figure B.70 (a-b): IDA 10% Crit Damp Structure Subjected to NF11	169
Figure B.71 (a-b): IDA 10% Crit Damp Structure Subjected to NF13	169
Figure B.72 (a-b): IDA 10% Crit Damp Structure Subjected to NF19	170
Figure B.73 (a-b): IDA 20% Crit Damp Structure Subjected to LA01	171
Figure B.74 (a-b): IDA 20% Crit Damp Structure Subjected to LA07	171
Figure B.75 (a-b): IDA 20% Crit Damp Structure Subjected to LA10	172
Figure B.76 (a-b): IDA 20% Crit Damp Structure Subjected to LA11	172
Figure B.77 (a-b): IDA 20% Crit Damp Structure Subjected to LA13	172
Figure B.78 (a-b): IDA 20% Crit Damp Structure Subjected to LA17	173
Figure B.79 (a-b): IDA 20% Crit Damp Structure Subjected to NF01	173
Figure B.80 (a-b): IDA 20% Crit Damp Structure Subjected to NF07	173
Figure B.81 (a-b): IDA 20% Crit Damp Structure Subjected to NF09	174
Figure B.82 (a-b): IDA 20% Crit Damp Structure Subjected to NF11	174
Figure B.83 (a-b): IDA 20% Crit Damp Structure Subjected to NF13	174
Figure B.84 (a-b): IDA 20% Crit Damp Structure Subjected to NF19	175
Figure B.85 (a-b): Percent Reduction IDA 10% Crit Damp LA01	176
Figure B.86 (a-b): Percent Reduction IDA 10% Crit Damp LA07	176

Figure B.87 (a-b): Percent Reduction IDA 10% Crit Damp LA10	177
Figure B.88 (a-b): Percent Reduction IDA 10% Crit Damp LA11	177
Figure B.89 (a-b): Percent Reduction IDA 10% Crit Damp LA13	177
Figure B.90 (a-b): Percent Reduction IDA 10% Crit Damp LA17	178
Figure B.91 (a-b): Percent Reduction IDA 10% Crit Damp NF01	178
Figure B.92 (a-b): Percent Reduction IDA 10% Crit Damp NF07	178
Figure B.93 (a-b): Percent Reduction IDA 10% Crit Damp NF09	179
Figure B.94 (a-b): Percent Reduction IDA 10% Crit Damp NF11	179
Figure B.95 (a-b): Percent Reduction IDA 10% Crit Damp NF13	179
Figure B.96 (a-b): Percent Reduction IDA 10% Crit Damp NF19	180
Figure B.97 (a-b): Percent Reduction IDA 20% Crit Damp LA01	181
Figure B.98 (a-b): Percent Reduction IDA 20% Crit Damp LA07	181
Figure B.99 (a-b): Percent Reduction IDA 20% Crit Damp LA10	182
Figure B.100 (a-b): Percent Reduction IDA 20% Crit Damp LA11	182
Figure B.101 (a-b): Percent Reduction IDA 20% Crit Damp LA13	182
Figure B.102 (a-b): Percent Reduction IDA 20% Crit Damp LA17	183
Figure B.103 (a-b): Percent Reduction IDA 20% Crit Damp NF01	183
Figure B.104 (a-b): Percent Reduction IDA 20% Crit Damp NF07	183
Figure B.105 (a-b): Percent Reduction IDA 20% Crit Damp NF09	184
Figure B.106 (a-b): Percent Reduction IDA 20% Crit Damp NF11	184
Figure B.107 (a-b): Percent Reduction IDA 20% Crit Damp NF13	184
Figure B.108 (a-b): Percent Reduction IDA 20% Crit Damp NF19	185
Figure B.109: Residual Displacement IDA 20% Crit Damp LA01	186
Figure B.110: Residual Displacement IDA 20% Crit Damp LA07	186
Figure B.111: Residual Displacement IDA 20% Crit Damp LA10	186
Figure B.112: Residual Displacement IDA 20% Crit Damp LA11	187
Figure B.113: Residual Displacement IDA 20% Crit Damp LA13	187
Figure B.114: Residual Displacement IDA 20% Crit Damp LA17	187
Figure B.115: Residual Displacement IDA 20% Crit Damp NF01	188
Figure B.116: Residual Displacement IDA 20% Crit Damp NF07	188
Figure B.117: Residual Displacement IDA 20% Crit Damp NF09	188
Figure B.118: Residual Displacement IDA 20% Crit Damp NF11	189
Figure B.119: Residual Displacement IDA 20% Crit Damp NF13	189
Figure B.120: Residual Displacement IDA 20% Crit Damp NF19	189
Figure B.121 (a-b): IDA 20% Crit Damp $\alpha=0.5$ 1% w/ Yield Braces LA01	190
Figure B.122 (a-b): IDA 20% Crit Damp $\alpha=0.5$ 1% Drift w/ Yield Braces LA10	190
Figure B.123 (a-b): IDA 20% Crit Damp $\alpha=0.5$ 1% Drift w/ Yield Braces NF01	191
Figure B.124 (a-b): IDA 20% Crit Damp $\alpha=0.5$ 1% Drift w/ Yield Braces NF07	191
Figure B.125 (a-b): IDA 20% Crit Damp $\alpha=0.5$ 1% Drift w/ Yield Braces NF07	191
Figure B.126 (a-b): IDA 20% Crit Damp $\alpha=1.0$ w/ Yield Braces LA01	192
Figure B.127 (a-b): IDA 20% Crit Damp $\alpha=1.0$ w/ Yield Braces LA10	192
Figure B.128 (a-b): IDA 20% Crit Damp $\alpha=1.0$ w/Yield Braces NF01	193
Figure B.129 (a-b): IDA 20% Crit Damp $\alpha=1.0$ w/ Yield Braces NF07	193
Figure B.130 (a-b): IDA 20% Crit Damp $\alpha=1.0$ w/ Yield Braces NF07	193
Figure B.131 (a-b): IDA 20% Crit Damp $\alpha=1.5$ 1% Drift w/ Yield Braces LA01	194
Figure B.132 (a-b): IDA 20% Crit Damp $\alpha=1.5$ 1% Drift w/ Yield Braces LA10	194

Figure B.133 (a-b): IDA 20% Crit Damp $\alpha=1.5$ 1% Drift w/ Yield Braces NF01	.....195
Figure B.134 (a-b): IDA 20% Crit Damp $\alpha=1.5$ 1% Drift w/ Yield Braces NF07	.....195
Figure B.135 (a-b): IDA 20% Crit Damp $\alpha=1.5$ 1% Drift w/ Yield Braces NF07	.....195
Figure B.136: RD-IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift w/Yield Braces LA01	.....196
Figure B.137: RD-IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift w/Yield Braces LA10	.....196
Figure B.138: RD-IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift w/Yield Braces NF01	.....197
Figure B.139: RD-IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift w/Yield Braces NF07	.....197
Figure B.140: RD-IDA 20% Crit Damp $\alpha=0.5$ at 1% Drift w/Yield Braces NF11	.....197
Figure B.141: RD-IDA 20% Crit Damp $\alpha=1.0$ w/Yield Braces LA01	.....198
Figure B.142: RD-IDA 20% Crit Damp $\alpha=1.0$ w/Yield Braces LA10	.....198
Figure B.143: RD-IDA 20% Crit Damp $\alpha=1.0$ w/Yield Braces NF01	.....199
Figure B.144: RD-IDA 20% Crit Damp $\alpha=1.0$ w/Yield Braces NF07	.....199
Figure B.145: RD-IDA 20% Crit Damp $\alpha=1.0$ w/Yield Braces NF11	.....199
Figure B.146: RD-IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift w/Yield Braces LA01	.....200
Figure B.147: RD-IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift w/Yield Braces LA10	.....200
Figure B.148: RD-IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift w/Yield Braces NF01	.....201
Figure B.149: RD-IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift w/Yield Braces NF07	.....201
Figure B.150: RD-IDA 20% Crit Damp $\alpha=1.5$ at 1% Drift w/Yield Braces NF11	.....201
Figure B.151 (a-b): DI-IDA 10% (a) and 20% (b) $\alpha=0.5$ at 1% Drift	.....202
Figure B.152 (a-b): DI-IDA 10% (a) and 20% (b) $\alpha=1.0$	.....202
Figure B.153 (a-b): DI-IDA 10% (a) and 20% (b) $\alpha=1.5$ at 1% Drift	.....203
Figure B.154: DI-IDA 10% Crit Damp LA01(a) and LA10 (b)	.....204
Figure B.155: DI-IDA 10% Crit Damp LA13(a) and NF01 (b)	.....204
Figure B.156: DI-IDA 10% Crit Damp NF07(a) and NF13 (b)	.....204
Figure B.157: DI-IDA 10% Crit Damp LA01(a) and LA10 (b)	.....205
Figure B.158: DI-IDA 20% Crit Damp LA13(a) and NF01 (b)	.....205
Figure B.159: DI-IDA 20% Crit Damp NF07(a) and NF13 (b)	.....205

List of Tables

Table 3.1: Section Properties	29
Table 3.2: Moment-Rotation Properties for Inelastic Beam Hinges	35
Table 3.3: Moment-Rotation Properties for Inelastic Column Hinges	36
Table 3.4: Panel Zone Hinge Properties	42
Table 3.5: Periods and Mode Shapes for First Five Modes of Vibration	42
Table 3.6: Ground Motions Used in Study	55
Table 4.1: Residual Displacements for Structure with Linear Dampers	98
Table 4.2: Std Dev IDR and Avg RD for LA and NF when $\alpha=0.5$ and 1.5	104
Table A.1: Section Properties for SDOF Frame	126
Table A.2: Properties for SDOF Frame w/ Fluid Viscous Damper	128
Table A.3: Spring Stiffness Sensitivity Analysis	131
Table A.4: Max. Iteration Limit and Min. Sub-step Size Sensitivity Analysis	132
Table A.5: Relative Force and Energy Tolerances Sensitivity Analysis	133
Table A.6: Perform Time Step Analysis	134
Table A.7: Perform Time Step Analysis, $k=10000$ (k/in.)	134
Table A.8: Perform Time Step Analysis, $k=1000000$ (k/in.)	135
Table A.9: Perform Time Step Analysis, $k=100000$ (k/in.) $C0=5$ (k-sec/in.)	135
Table A.10: Perform Time Step Analysis, $k=100000$ (k/in.) $C0=15$ (k-sec/in.)	136