

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

by

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Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University  
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE  
in  
CIVIL ENGINEERING

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March 17, 2003  
Blacksburg, Virginia

Keywords: Incremental Dynamic Analysis, Fluid Viscous Damping, Near-Field  
Earthquakes, Residual Displacements

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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.

# Acknowledgements

I would like to show my appreciation for all of the people who helped me when I was working on the thesis. First I would like to thank my advisor and committee chair, Dr. Finley Charney, for all of his support, guidance, and patience. I am grateful that he shared so much of his knowledge and experience with me; it was a privilege to work for him. I would also like to thank my other committee members, Dr. Thomas Murray and Dr. Raymond Plaut, for taking the time to provide valuable insight for my thesis and for all the help they have offered me during the time I have spent at Virginia Tech.

I would also like to thank all of the family, friends, and fellow graduate students that have helped me along the way, whether they knew it or not. Those who have shared similar experiences provided me with much reassurance and confidence when it was needed the most. Special thanks go to my parents, Ralph and Mary Oesterle, and sisters, Jane Werling and Nan Walicki, for their support, patience, and love. You all serve as an example of what I strive to be when I grow up. Finally, I thank Nani Au for her constant love and encouragement; I cannot imagine what this experience would have been like without her.

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