

## **Financial Benefit of Retrofitting Seismic-Risk Buildings with Passive Control Devices**

Seda Dogruel

*Ph.D. Candidate, Dept. of Civil, Structural, and Environmental Engineering, University at Buffalo, State University of New York  
Buffalo, NY 14260, Phone: (716) 645-2114 Ext 2436, E-mail:sdogruel@buffalo.edu*

A new decision-support model is developed for making well-informed retrofit decisions in seismic-risk management of structures retrofitted with passive control devices (PCD). Optimal design of passively damped structures in highly seismic environments requires not only choosing the most cost-effective approach from a series of alternatives but also defining the risk associated with each retrofit alternative. Thus, unlike previous works in PCD optimization, the proposed decision-support tool uses multi-criteria genetic algorithm to maximize the overall economic benefit of structural control system through different measures of risk that reflects physical and economical uncertainties, as well as the attitudes of decision makers. Risk measure characterizes the risk tolerance of the decision makers and allows the evolution of rational design or retrofit strategies that depend upon the level of risk aversion to low probability-high impact events. Through a review of different risk measures, a uniform and robust multi-criteria decision tool is created to:

- provide a systematic and efficient approach for quantifying and evaluating the trade-offs between key decision components (i.e., benefit, cost, performance level, and risk) and deciding on optimal design /retrofit alternatives, therefore suggests a more efficient investment allocations for mitigation of existing structures
- enable a decision maker to more accurately assess how the risk preferences affect the overall design/retrofit alternatives

Besides presenting an outline of the risk-based computational framework, the paper includes numerical simulations to emphasize the financial benefits of using passive control devices to make retrofit decisions regarding seismic safety.