Advances in Performance-Based Earthquake Engineering
Michael N. Fardis, Editor
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Conventional structural design emphasizes the means to the end, that is, a prescriptive approach with rules that, if followed, suffice to call it a good design, even though the consequences may result in structural failure and significant losses. Now "Performance-Based Engineering" focuses on the end results: the engineered structure must meet its intended purpose(s) and consequences. Thus, it is based on designing to the end results.

Performance-Based Earthquake Engineering, specifically for motion and displacement of the ground, tries to maximize the utility by minimizing expected total cost (work on structure, repairs, utility and casualties). This approach has been introduced somewhat in codes detailing with seismic assessment. The tools to do this are what is discussed in this book, based on a workshop held in Greece in 2009.

With 107 contributors (authors and coauthors) you can bet there are a lot of chapters. I will briefly review the distinct four parts and comments on the essence of the chapters.

Part 1 Ground motions for performance-based earthquake engineering (with nine chapters). This series of chapters contains case studies of ground motion (and displacements) in order to help determine the consequences of any given earthquake. A SDOF (single-degree-of-freedom) analysis is used by several authors.

Part 2 Performance-based seismic design and retrofitting methodologies (with 14 chapters). Topics here include the methodologies using probabilistic design to help determine effects of earthquakes on structures and on ground motion (displacement). Discussions are on structures and their expected structural and visual damages and failures. Further there is a treatment using nonlinear (inelastic) behaviors of structures when they are subject to seismic excitation.

Part 3 Performance-based seismic design and retrofitting implementation (with 14 chapters). The focus of this part is the implementation of the methodologies presented in the previous chapters and several others comparing laboratory testing to field testing. Some of the specific topics discussed include seismic isolation, modal analysis of bridges and cost–benefit analysis. Most interesting was the chapter titled "Recent advances in seismic isolation: methods and tools" by P. Tsopelas and S. Kunnath, which showed some unique approaches using a friction-pendulum isolator.

Part 4 Advanced seismic testing for performance-based earthquake engineering (with seven chapters). This set of chapters deals with testing; most chapters, using models of structures on shakers, but one, using large-scale (about 15 m high) specimens.

Even though the book has many authors and co-authors, it is extremely well-edited with chapters easy to read. However, reading them and understanding all of the materials supplied is another issue. Most of the papers are highly technical, with very sophisticated mathematics. Further, this book is mostly concerned with effects of earthquakes on structures and the ramifications of failure or damage. It does not deal with say, seismic activity on laboratory test benches or on isolated machinery that might fall or fail because of a seismic event.

The ACES workshop, for which the title of this book was named, was held in July 2009 in Greece. Clearly the book is meant for engineers dealing with earthquakes but could be of real interest to noise control (acoustical) and vibration engineers who need to know about earthquake response.

Recommended.

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