BOOK REVIEW

Title: **"Response Spectrum Method in Seismic Analysis and Design of Structures"**

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Chapter headings:
1. Structural dynamics and response spectrum.
2. Design spectrum.
3. Combination of modal responses.
4. Response to multi-components of earthquake.
5. Non-classically damped systems.
6. Response of secondary systems.
7. Decoupled primary system analysis.
8. Seismic response of buildings.

Appendix. Numerical evaluation of response spectrum.

This book on the Response Spectrum Method contains much useful and interesting information associated with the application of the method in analysis and design. While the theory of spectra has been understood for some time, it is only over the last twenty years or so that the approach has become widely adopted by analysts and designers and become the most commonly used method of analysis in earthquake engineering. This is largely due to the fact that it provides the designer with a rational and simple basis for specifying the earthquake loading. The method is also computationally simple. There was also a need for a simple approach that could be used in writing building codes and for use in the advanced analysis used for designing nuclear power plants and lifeline systems.

The author's interest in the response spectrum method began some twenty years ago when, as a practising engineer, he was asked to investigate how to combine responses from three components of an earthquake. Since 1980, the author has supervised a series of students who have investigated aspects of the response spectrum method including modal combination methods and the coupled response of secondary systems. The outcome of this research - along with that from many other researchers - forms the subject matter for this book. Not surprisingly, a large number of references are listed at the end of each chapter.

Throughout the book it is assumed that linear systems are being dealt with, though chapter 2 does give a brief treatment of inelastic response spectra while chapter 8 deals with the seismic response of conventional buildings. The author acknowledges that inelastic seismic behaviour and design continue to be topics of active research but lie outside the scope of this book. The main emphasis of the book is on deterministic modelling of earthquake response, though it is pointed out that modal combination rules are based partly on the physics of the problem (which are deterministic), and partly on random vibration modelling. Probabilistic concepts play an important role in the definition of the design spectrum, as they do in defining other kinds of loads. However, the important contributions that have taken place in recent years in the development and application of random vibration techniques to the response spectrum method are not covered in any detail.

One criticism of the response spectrum method is that the temporal information is lost in the process of evaluating the spectrum. However, in view of the progress made during the last decade, the author points out that this is no longer a handicap. Rational rules are now available to combine responses from various modes and the three components of earthquake motion. These rules account for the physics of the problem and represent expected response values, albeit with a degree of uncertainty. Response of secondary systems can now be evaluated using efficient modal synthesis techniques in conjunction with the response spectrum method. These techniques can use the design response spectrum at the base of the primary structure as the seismic input and can account for the effects of mass interaction and of multiple support input into the secondary system. Non classical damping can also be addressed.

The author has succeeded in his objective of bringing together in one volume the wealth of information about the response spectrum method that has been generated in recent years. The book should be a useful reference for practising engineers needing to apply the method, especially when looking at the interaction between plant and services and the structure containing them. However, in the New Zealand context where structures are designed for the ultimate limit state based on capacity design principles, the response spectrum method based on linear behaviour can only give approximate results and the results of the continuing research into the application of inelastic spectra is awaited with interest. The book is well laid out and illustrated and should be recommended reading for engineers who are involved in the analysis and design of structures that must resist seismic actions.