

Displacement – Based Seismic Design of Structures

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ÂBSTRACT (condensed):

Displacement – Based Seismic Design of Structures is a book primarily directed towards practicing structural designers who are interested in applying performance – based concepts to seismic design.

The design philosophy is based on determination of optimum structural strength to achieve a given performance limit state, related to a defined level of damage, under a specific level of seismic intensity. Emphasis is also placed on how this strength is distributed through the structure. This takes two forms: methods of structural analysis and capacity design. It is shown that equilibrium considerations frequently lead to a more advantageous distribution of strength than that resulting from stiffness considerations. Capacity design considerations have been re-examined, and new and more realistic design approaches are presented to insure against undesirable modes of inelastic deformation.

The book considers a wide range of structural types, including separate chapters on frame buildings, wall buildings, dual wall/ frame buildings, masonry buildings, timber structures, bridges, structures with isolation or added damping devices, and wharves. These are preceded by introductory chapters discussing conceptual problems with current force-based design, seismic input for displacement based design, fundamentals of direct displacement – based design, and analytical tools appropriate for displacement based design. The final two chapters adapt the principles of displacement –based seismic design to assessment of existing structures, and present the previously developed design information in the form of a draft building code.

The text is illustrated by copious worked design examples (39 in all), and analysis aids are provided in the form of a CD containing three computer programs covering moment-curvature analysis (*Cumbia*), linear-element-based inelastic time-history analysis (*Ruaumoko*), and a general fibre-element dynamic analysis program (*SeismoStrut*).

The design procedure developed in this book is based on a secant-stiffness (rather than initial stiffness) representation of structural response, using a level of damping equivalent to the combined effects of elastic and hysteretic damping. The approach has been fully verified by extensive inelastic time history analyses, which are extensively reported in the text. The design method is extremely simple to apply, and very successful in providing dependable and predictable seismic response.