



Theory of Nonlinear Structural Analysis: The Force Analogy Method for Earthquake Engineering

By Gang Li, Kevin Wong

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A comprehensive book focusing on the Force Analogy Method, a novel method for nonlinear dynamic analysis and simulation

This book focusses on the Force Analogy Method, a novel method for nonlinear dynamic analysis and simulation. A review of the current nonlinear analysis method for earthquake engineering will be summarized and explained. Additionally, how the force analogy method can be used in nonlinear static analysis will be discussed through several nonlinear static examples. The emphasis of this book is to extend and develop the force analogy method to performing dynamic analysis on structures under earthquake excitations, where the force analogy method is incorporated in the flexural element, axial element, shearing element and so on will be exhibited. Moreover, the geometric nonlinearity into nonlinear dynamic analysis algorithm based on the force analogy method is included. The application of the force analogy method in seismic design for buildings and structural control area is discussed and combined with practical engineering.

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Editorial Review

From the Back Cover

Nonlinear structural analysis in civil engineering is not a new topic. The Force Analogy Method as a relatively new algorithm was first developed in 1999 for solving nonlinear dynamic analysis problems.

Conventional methods for calculating the nonlinear behavior of civil engineering structures use the analysis procedure of changing the structural member stiffness, while structural dynamics is incorporated into the procedure through implicit time integration of the varying stiffness matrices. Examples of these conventional methods include the Wilson-and Newmark- methods. In these conventional methods, the major problem is that significant iterative computations in updating the time-varying stiffness matrices have to be performed to ensure numerical convergence once the structure experiences yielding and nonlinear deformation. As a result, the iterative operation is time consuming and the entire dynamic analysis process becomes practically uneconomical. By using the force analogy method, on the other hand, the state-transition matrix needs to be computed only once due to the constant use of the initial stiffness of the structure, and this greatly simplifies the overall computation and makes the nonlinear analysis readily available for solving various practical problems.

The book:

- Introduces an analytical/computational method of nonlinear analysis of structure –the Force Analogy Method
- Covers both the theoretical background and practical applications in seismic analysis of structures
- New topic, not currently covered in any books, authored by experts in the area

This book is essential reading for professional scientists, engineers and researchers in structural engineering. Graduate and undergraduate students in civil engineering, software developers will also find it helpful.

About the Author

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