DEPARTMENT OF CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING

University at Buffalo The State University of New York

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ENGINEERING SEMINAR

Recent Advances on Seismic Evaluation and Displacement-Based Design of Structures

Abstract

Recent years have witnessed major advances in the development of the criteria, methods and tools of earthquake engineering. However, these advances have not yielded a reduction in structural damage caused by recent earthquakes in regions where this advanced engineering is practiced. This discrepancy can be partially attributed to the failure of current regulations on the estimation of design seismic demands within the design methods. These estimations are generally based on forces rather than displacements or other performance indices more related to structural damage caused by earthquakes. The current trend in earthquake engineering studies focuses on the development of methods and tools to ensure the performance of a building subject to demands for seismic design goals that comply with the limit states or performance levels defined by performance indicators related to structural and nonstructural damage to a building. These limit and performance states are often represented in terms of displacement, ductility, damage rates, energy dissipation, and maximum speeds among others.

This lecture presents a displacement-based design method based on the concept that structural behavior may be approximately characterized through the properties of a SDOF reference system based on the fundamental mode of vibration of the original structure. The formulation, based on basic concepts of structural dynamics, leads to a simple and straightforward evaluation and design procedure. The method seeks to guarantee a given performance objective in a more efficient manner through effective damage control of the structural system and a more rational control of displacements. An advance of the multilevel design and the robustness-based seismic assessment approach under development is also discussed. To illustrate its potential, the method is applied to several regular and irregular reinforced concrete and steel frames. Its validation is also demonstrated through nonlinear dynamic analyses. It is shown that this evaluation and design method can benefit new seismic design regulations in Mexico and elsewhere.

Amado Gustavo Ayala-Milián, Ph.D.

Born in Mexico City and graduated from the Faculty of Engineering (FI) of the National Autonomous University of Mexico (UNAM), where he obtained a Diploma in Civil Engineering, a Master of Engineering, doctoral credits in Structural Engineering and graduate courses in Systems Engineering. Ayala obtained his PhD in engineering from Southampton University in Great Britain and a Diploma in Wind Engineering from the VKI in Belgium. He has worked actively for the past 44 years in the development, implementation and application of methods for the solution of problems of structural and fluid mechanics and structural and earthquake engineering. He is a full research professor of the Institute of Engineering (II) of UNAM since 1974, a National Researcher and numbered member of the Mexican Academy of Engineering and an honorary member of the Mexican Society of Structural Engineering. He has been visiting professor at several prestigious universities, including Waterloo in Canada and Cornell, VPI, SU and RPI in the United States. He has consulted for various domestic and foreign companies in problems related to his areas of expertise. As a researcher, he has published numerous technical papers and participated in many national and international conferences. His area of expertise includes the development and application of methods to solve Soil Mechanics, Structural and Earthquake Engineering problems. Since 1974 he has taught graduate courses in engineering and acts as a student tutor at UNAM and other universities. Within the II, he has been a research coordinator of Dynamics and founder and coordinator of Applied Mechanics. In the FI of UNAM he has been head of the graduate program in Structures. He has been a member of academic committees at UNAM involved in planning, policy making and the evaluation of resources and candidates of engineering graduate schools commissioned by the Ministry of Education and the National Council for Science and Technology of Mexico, among other institutions. He has served on national and international committees assessing projects and allocating resources to scientific research projects and merit awards. In 2005 he was awarded a Marie Curie research chair of the European Union and in 2006 the Research Award of the Mexican Society of Structural Engineering.

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Location: 140 Ketter Hall, North Campus, University at Buffalo

Webcast: http://civil.eng.buffalo.edu/webcast

Technical Questions: seeslwebcast@gmail.com

Refreshments will be served!

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