Department of Structural Engineering
University of California, San Diego
SE 290 Seminar

Professor Yannis Koutromanos
Department of Civil and Environmental Engineering
Virginia Polytechnic Institute and State University

"Finite Element Analysis of RC Structural Components Under Earthquake Loads"

Monday, June 5, 2017
1:00 pm - 1:50 pm, Pepper Canyon Hall, Room 122

http://structures.ucsd.edu/node/2126

Abstract

Reinforced concrete (RC) is a popular construction material for residential and commercial buildings, as well as bridges. The reliable determination of the performance and safety of RC structures is of uttermost importance towards ensuring resilient communities. During extreme loading events such as earthquakes, RC members can be subjected to large, cyclic inelastic strains which may lead to cracking, crushing, and spalling of concrete, and yielding, buckling and even fracture of the reinforcing steel. To predict structural performance and ensure that the potential for failure is sufficiently low, it is necessary to accurately describe the effect of various mechanisms affecting the dynamic response of RC structures. Experimental testing is the most reliable means for characterizing the inelastic response at the material, component and system level and determine the level of deformations that may entail failure. However, it is typically not possible to test full-scale structural systems for a sufficiently wide variety of structural configurations and loading scenarios. This means that experimental tests must be supplemented with computational simulation, using methods that can describe all significant aspects of material response.

This presentation will describe the formulation and implementation of detailed computational simulation tools for RC structures under earthquake loading. Constitutive models have been formulated for concrete and reinforcing steel and implemented in finite element analyses of RC structural components under cyclic loads. The capability of the models to simulate the response and damage patterns, including rebar buckling and subsequent rupture, is validated with the results of experimental tests. The validation analyses are supplemented with a discussion elucidating modeling aspects, such as the well-established spurious mesh size effect for softening material response with the corresponding regularization procedures, and the significance of accurately modeling the bond-slip of the steel reinforcement. Further investigations examine the relative merit and computational efficiency of explicit and implicit global solution schemes, the capability to capture full collapse of components, and the extension of the constitutive models to other types of materials such as ultra-high-performance concrete.

Biography

Yannis Koutromanos is an Assistant Professor in the Charles Edward Via, Jr. Department of Civil and Environmental Engineering at Virginia Tech. He obtained his Diploma in Civil Engineering from the National Technical University of Athens, and his M.Sc. and PhD degrees from UC San Diego. His research interests include constitutive modeling of inelastic materials, analytical performance assessment and retrofit of reinforced concrete, steel and masonry structures, and experimental evaluation of materials and structures. In 2012, he received the Outstanding Doctoral Dissertation Award from The Masonry Society (TMS), for his doctoral work on the analytical and experimental investigation of the seismic performance of masonry-infilled reinforced concrete frames. He is a voting member of the joint ASCE/ACI Committee 447, *Finite Element Analysis of Concrete Structures*.

http://structures.ucsd.edu/node/2126

Sponsored by Professor Kenneth Loh
For more information on this seminar, contact Lindsay Walton, at lwalton@ucsd.edu