

UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

Distinguished Lecture Series

Professor Armen Der Kiureghian

Taisei Professor of Civil Engineering
University of California, Berkeley

Bayesian Network for Infrastructure Seismic Risk Assessment and Decision

Friday, December 7, 2012

12:00 – 1:00 p.m. Seminar
Room L2D2, Engineering Lecture Hall, UH

Abstract

A Bayesian network (BN) is a probabilistic graph representing a set of random variables and their dependencies. BNs are intuitive (even non-experts can understand what is going on!), offer a transparent means for modeling, facilitate information updating, and can be augmented by decision and utility nodes to solve decision problems. In particular, the facility for information updating renders the BN an ideal tool for near real-time risk assessment and decision-making after a major disaster.

In this talk, BN models for spatially distributed infrastructure systems subjected to earthquake ground motions will be described. The model consists of three parts: (a) a model of the earthquake hazard, accounting for uncertainties in the earthquake characteristics and location, as well as the spatial correlation structure of the ground motion random field, (b) models of the system components in terms of fragility functions, and (c) a model of the system performance in terms of component states. Considering the immediate aftermath of a major earthquake, the BN updating tool is used to assess the states of the infrastructure system and its components, as the available information about the hazard and from observed states of system components evolves in time.

The updated probabilistic information, together with utility values for different outcomes, are used to make decisions regarding the operation of the system and its components, e.g., continued operation, operation at reduced capacity, or closure, or to select optimal ordering of inspections. A preliminary application of the method to a hypothetical model of the proposed California High Speed Rail system will be demonstrated.

About the speaker:



Armen Der Kiureghian is Professor and holder of Taisei Chair in Civil Engineering at the University of California, Berkeley. He received his B.S. and M.S. in Civil Engineering from the University of Teheran, Iran, and his Ph.D. in Structural Engineering from the University of Illinois at Urbana-Champaign.

He is one of the founders of the American University of Armenia, an affiliate of the University of California, and served as its Dean of Engineering (1991-2007) and Interim Provost (2011-2012) concurrently with his Berkeley position. Among several other awards, he is a recipient of the ASCE *Walter L. Huber Civil Engineering Research Prize* and *Alfred M. Freudenthal Medal*. He has been honored as a Distinguished Alumnus of the Department of Civil and Environmental Engineering of the University of Illinois at Urbana-Champaign, and elected as a member of the National Academy of Engineering.