ABSTRACT:
The demand for structural assessment frameworks that communicate their results in terms of performance measures which can be easily used in decision frameworks by stakeholders is becoming ever more important. Indeed, this approach to structural engineering actively promotes the goal of defining designs that rationally meet society's need for a truly safe built environment. Obviously the ultimate goal of any project is not to simply meet the performance objectives set by the stakeholders, but to do so in an economically optimum fashion. This can only truly be achieved through the development of appropriate optimization strategies that not only embrace the inevitably uncertain and aleatory nature of both system and environment, but also allow for the performance constraints to be written directly in terms of the decision variables. This seminar focuses on the definition of an optimization methodology that is embedded within the Pacific Earthquake Engineering Research (PEER) Center decision framework. The approach allows for the optimization of uncertain building systems, driven by stochastic loads, and subject to a large number of probabilistic constraints written directly in terms of decision variables governing the occurrence of structural and non-structural damage. The method centers on decoupling the probabilistic assessment analysis from the optimization loop through the introduction of a number of auxiliary variable vectors (AVVs). By assuming the aforementioned variables independent of the design variable vector, a sequential optimization strategy, herein denominated the AVV optimization approach, is defined. The practicality of the proposed approach is illustrated on two full scale building examples, the first of which concerns resilient extreme wind design while the other resilient seismic design.

BIO:
Seymour M.J. Spence is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Michigan, Ann Arbor. He joined the University of Michigan in September 2014 from the University of Notre Dame where he was a Research Assistant Professor in the NatHaz Modeling Laboratory. He earned his M.S. in Civil Engineering in 2005 from the University of Perugia, Italy, and received a joint Ph.D. from the University of Florence, Italy and the University of Braunschweig, Germany in 2009. His main research interests are centered on the areas of performance-based design and optimization theory applied to large-scale and uncertain structural systems. He is currently focusing on the development of a framework for the performance-based topology/design optimization of structural systems subject to wind loads, with combined time-variant/invariant uncertainties, as well as on the definition of methodologies and procedures for the efficient CFD-based aerodynamic shape optimization of tall buildings.