Multiscale Computational Simulation of Progressive Building Collapse

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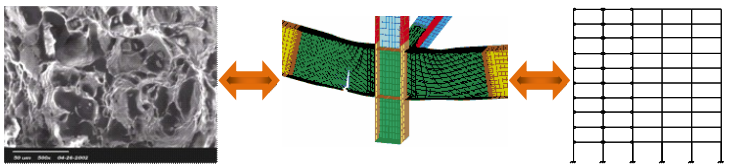
Talk Abstract
Predicting the response of a steel building to extreme loading, especially all the way up to collapse, is complicated by the need to account for a number of interlinked processes that take place along widely disparate length scales. At the micro-scale, micrometer sized voids in the steel matrix can nucleate and coalesce leading to the formation of a crack. At the macro-scale, the crack can grow forming a discontinuity (centimeters in length) that leads to a rapid change in member structural properties. At the structural-scale, i.e. in regions measured in meters, the damaged member can trigger instability in subassemblage response potentially leading to a chain of other interlinked micro-, macro- and structural-scale processes that ultimately stop when the building system reaches equilibrium or collapses into a debris pile. My talk will start off by describing my general research interest in multi-scale collapse modeling then focus on simulating progressive structural collapse and some of the engineering aspects that influence the collapse-resistance of steel buildings. I will also describe some tools that we have developed to visualize finite element results in virtual and augmented reality environments with the purpose of assisting and training first response teams that operate in the immediate aftermath of disasters.



Biography:
Sherif El-Tawil received his BS and MS from Cairo University, Egypt, and PhD in 1996 from Cornell University, Ithaca, NY. His current research interest pertain to how buildings and bridges behave under the extreme loading conditions generated by manmade and natural hazards such as seismic excitation, collision by heavy objects, and blast. Much of his research is focused on the computational and theoretical aspects of structural engineering. He is chair of ASCE's Technical Administrative Committee on Metals and is Managing Editor of the Journal of Structural Engineering. He has received numerous research, teaching and service awards including ASCE's Normal Medal, Moisseiff Award, Huber Civil Engineering Research Prize and Wellington Award.

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