Civil and Environmental Engineering

Structures and Applied Mechanics Seminar Series

Present

“The Bearing Performance of the Bolt-Sphere Joints with Stochastic Pitting Corrosion Damage”

Speaker:

Hao Yuan, Ph.D. student

Abstract: The durability of the lattice domes is degraded when working in a highly corrosive environment. With the increase in service time, the aggravation of corrosion at joints, in our case, bolted spherical nodes, will lead to the decrease of the ultimate bearing capacity of the lattice domes, and finally the overall failure of the structures. However, at present, the studies are limited on the degradation of bolted spherical nodes caused by corrosion especially pitting corrosion. Therefore a pilot study is performed on the ultimate bearing capacity of the bolt-sphere joint portion in the bolted spherical nodes with stochastic pitting corrosion damage. Aided by the commercial finite element software ABAQUS, the bolt-sphere joints are modeled in 3D incorporating the helical thread contact. The corrosion damage is induced by explicitly adding uniform distributed pits on the intact model while the pit depth distribution is depending on the corrosion rate and service time. Through fine numerical analyses, specifically a number of uniaxial tension test simulations under different corrosion time, a group of load-displacement curves of the process are obtained. The stiffness variation in the whole loading process, the ultimate bearing capacity and failure mode of joints can also be estimated.

“Macroscale Modeling of Viscoelastic Behavior in FRP Tubes”

Speaker:

Angela Lanning, Ph.D. student

Abstract: Fiber-reinforced polymer (FRP) tubes are a primary component in concrete-filled FRP tube (CFFT) systems, which have been used as an alternative to reinforced concrete (RC) bridge columns. Current modeling methods for FRP tubes often neglect plastic strains, energy dissipation, and any short-term effects of creep or relaxation. These modeling methods focus on constant-rate cyclic loading and have shown to under-predict the unloading stiffness, energy dissipation and peak axial force making them unsuitable for use in seismic design. Therefore, an improved modeling methodology has been developed for FRP tubes to enhance the modeling capabilities of CFFT columns. The proposed FRP material model incorporates the viscoelastic tendencies of FRP tubes, improving accuracy in predicting energy dissipation, peak-forces, and time-dependent behavior. The inclusion of viscoelastic properties allows the analytical model to consider critical time-dependent and rate-dependent aspects of the FRP tube, making it more suitable for predicting the seismic response of CFFTs. Experimental results from tension and compression tests of FRP tubes performed at University of Connecticut were used to validate the analytical model at the material level. The model was then brought to the system level and validated against two shake-table tests of CFFT columns performed at the University of Nevada-Reno. The proposed model showed better agreement with the experimental results than current modeling methods.

Friday, March 9, 2018

12:20 – 1:10 PM, Laurel Hall (LH) - Room 206