Stony Brook University

Department of Civil Engineering

College of Engineering and Applied Sciences

FALL 2022 SEMINAR SERIES

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Friday, November 4th, 1:00 – 1:55 PM
Frey Hall Room 201

Multi-hazard risks of large-scale hospital and power systems

Abstract

Extreme hazard events can cause catastrophic consequences for multiple systems of urban centers. For example, earthquakes can damage hospitals and, at the same time, injure tens or even hundreds of thousands of people in minutes, creating overwhelming demands for medical treatment, as in China in 2008 and Turkey in 1999. Also, disasters severely affect the power grid. The recent category-4 Hurricane Ian left 2.6 million people without power in Florida. This three-part presentation will show models and applications for evaluating the impact of earthquakes, hurricanes, and compounding heatwaves and cyberattacks on large-scale urban systems. The first part will describe a formulation to capture critical processes that govern the emergency response of complex urban centers to large earthquakes. With a case study in Lima, Peru, I will showcase how this proposed methodology can help strategize patient transfers, ambulance usage, and deployment of field hospitals to make treatment more effective during an earthquake emergency. The second part will show a new methodology that quantifies the losses of solar generation during hurricanes due to two critical and compounding factors: transient cloud conditions that decrease irradiance and high winds that can cause permanent panel damage. I will also show the application of the methodology to the entire East Coast of the United States to elucidate the risk landscape of solar generation, highlighting risk hotspots in Florida and Louisiana. Finally, the third part will illustrate that compounding weather events and cyberattacks constitute a severe threat to critical infrastructure. I will show that when the power system is stressed by a heatwave, a deliberate and targeted cyberattack can leave tens of thousands of customers without power in the New York Independent System Operator. These methods and applications show how risk assessments for hospital and power systems can help resilience

officers and emergency responders to develop more robust risk reduction programs and protect their most vulnerable communities from extreme events.

Speaker Biography

Luis Ceferino has been an Assistant Professor in the Civil and Urban Engineering Department and the Center for Urban Science and Progress at New York University (NYU) since 2021. Prof. Ceferino is the director of the NYU Disaster Risk Analysis Lab, where his research group combines rigorous uncertainty quantification methods, structural modeling, and optimization techniques to elucidate the impact of extreme events on urban systems and strategize solutions for urban resilience. Previously, Ceferino was a Distinguished Postdoctoral Fellow at the Andlinger Center for Energy and the Environment at Princeton University, where he investigated modern power systems' resilience to hurricanes. He completed his M.S. degree in Structural Engineering at the John A. Blume Earthquake Engineering Center at Stanford University in 2014 and his undergraduate studies in Civil Engineering at the Universidad Nacional de Ingeniería in Lima, Peru (B.S. in 2011). He also earned his Ph.D. in the Civil and Environmental Engineering Department at Stanford University. Ceferino has conducted earthquake risk analyses for the World Bank to support country-wide retrofitting policies in Central Asia.