



Distinguished Faculty Spotlight



Advances in Computer Vision– based Civil Infrastructure Inspection and Monitoring

B. F. Spencer, Jr.

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Abstract:

Computer vision techniques, in conjunction with acquisition through remote cameras and unmanned aerial vehicles (UAVs), offer non-contact solutions to civil infrastructure condition assessment. The ultimate goal of such a system is to automatically and robustly convert the image or video data into actionable information. This presentation provides an overview of recent advances in computer vision techniques as they apply to the problem of civil infrastructure inspection and monitoring. In particular, relevant work in the fields of computer vision, machine learning, and structural engineering are presented. The applications reviewed are classified into two types: inspection applications and monitoring applications. The inspection applications reviewed include identifying context such as structural components, characterizing local and global visible damage, and detecting changes from a reference image, with focus on rapid structural condition assessment of buildings and bridges after disasters. The monitoring applications discussed include static measurement of strain and displacement, as well as dynamic measurements of displacement and modal analysis. The paper concludes with a discussion of promising areas of growth for research in the field of computer vision-based civil infrastructure inspection and monitoring, which will ultimately lead to more effective management of our civil infrastructure.

Bio:

B.F. Spencer, Jr. received his Ph.D. in theoretical and applied mechanics from the University of Illinois at Urbana-Champaign in 1985. He worked on the faculty at the University of Notre Dame for 17 years before returning to the University of Illinois at Urbana-Champaign, where he currently holds the Nathan M. and Anne M. Newmark Endowed Chair in Civil Engineering and is the Director of the Newmark Structural Engineering Laboratory. His research has been primarily in the areas of structural health monitoring, structural control, cyberinfrastructure applications, stochastic fatigue, stochastic computational mechanics, and natural hazard mitigation. Dr. Spencer has directed more than \$60M in funded research and published more than 700 technical papers/reports, including two books. He was the first to study and design magnetorheological (MR) fluid dampers for protection of structures against earthquakes and strong winds, overcoming the inherent limitations of existing passive energy dissipation systems, as well as power-dependent active control systems. He led NSF's George E. Brown Network for Earthquake Engineering Simulation (NEES) system integration project, which constituted the nation's first engineering cyberinfrastructure initiative. His research on structural health monitoring systems and smart wireless sensors integrates advanced computing tools with smart sensors, to provide a functional platform with self-interrogation capabilities. Dr. Spencer has received numerous awards, including the ASCE Outstanding Instructor Award, the ASCE Norman Medal, the ASCE Housner Structural Control and Monitoring Medal, the ASCE Newmark Medal, the Zhu Kezhen International Lectureship Award, the ANCRISST Outstanding Senior Investigator Award, the Structural Health Monitoring Person of the Year Award, the J.M. Ko Medal of Advances in Structural Engineering, IASCM Takuji Kobori Prize, and the Raymond & Sidney Epstein Structural Engineering Faculty Award. Dr. Spencer is a Fellow of ASCE, a Foreign Member of the Polish Academy of Sciences, the North American Editor in Chief of Smart Structures and Systems, the Executive Managing Editor of the journal of Earthquake Engineering and Engineering Vibration, the past president of the Asia-Pacific Network of Centers for Research in Smart Structures Technology, and a Designated Foreign Expert by China's State Administration of Foreign Experts Affairs.

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RSVP: <https://go.cee.illinois.edu/Distinguished-Faculty-Seminar-Prof-Spencer>