



# Northeastern

**Department of Civil and Environmental Engineering Distinguished Seminar Series**

## **Strain-Based Structural Health Monitoring using Advanced Sensing Technologies**

**Branko Glišić**

Associate Professor of Civil and Environmental Engineering

Princeton University

**Thursday, April 13, 2017 12:00 pm-1:00pm**

**458 Richards Hall**

### **Abstract**

Materials fail at a point in a structure when the stress at that point surpasses the strength of the material. This indicates that stress would be an ideal parameter to monitor, however, practical stress monitoring is not possible in real-life settings. Mechanical strain component is a parameter directly correlated to stress, and thus changes in the stress fields are reflected into changes in the strain field. Hence, the first signs of mechanical damage to a structure often occur in the form of strain-field anomalies. Typical examples are non-structural cracks in concrete (as early indicators of damage caused by frost, alkali-reaction, overloading, rheological effects or corrosion in reinforced bars), as well as cracks and bowing in steel (as early indicators of fatigue and loss of local stability). Consequently, strain has an excellent potential to enable effective Structural Health Monitoring (SHM) solutions. The aim of this seminar is to present the recent advances on strain-based SHM carried out at SHMlab of Princeton University. Focus is on the methods that can be universally applied to numerous types of structures. The first presented set of methods is related to global SHM based on parallel topology of discrete long-gauge fiber-optic strain sensors. It combines long-gauge strain measurements with innovative algorithms for assessment of universal parameters of beam-like structures, such as the location of the neutral axis and prestress force distribution. Follows set of methods related to integrity monitoring based on 1D distributed fiber-optic strain sensors and a novel 2D sensing sheet based on large area electronics. Performances of the methods are evaluated on real bridges, the Streicker Bridge at Princeton University Campus and US202/NJ23 overpass in Wayne, NJ.

### **Biographical Sketch**

Branko Glišić received his degrees in Civil Engineering and Theoretical Mathematics at University of Belgrade, Serbia, and Ph.D. at the EPFL, Switzerland. After eight-year long experience at SMARTEC SA, Switzerland, where he was involved in numerous practical and research SHM projects, he has been employed as an Assistant Professor at Department of Civil and Environmental Engineering of Princeton University. His main areas of interest are SHM methods, advanced sensors based on fiber-optics, large-area electronics and conductive polymers, SHM data management and analysis, smart structures and heritage structures. Prof. Glišić received 2013 SHM Person of the Year Award by the editors and associate editors of "Structural Health Monitoring: An International Journal", as well as several other awards. He is author and co-author of more than hundred published papers, short courses on SHM, and the book "Fibre Optic Methods for Structural Health Monitoring". He is a Council Member and Vice President for Education of ISHMII, editor-in-chief of ISHMII's newspaper 'The Monitor', member of several other professional associations (ACI, IABMAS, ASCE, etc.) and member of editorial boards of journals ASE, SMM and specialty section of FiBE on Structural Sensing.



# Branko Glisic

**Associate Professor,  
Department of Civil and Environmental Engineering,  
PRINCETON UNIVERSITY**

## Education

- **PhD in Civil Engineering, *SWISS FEDERAL INSTITUTE OF TECHNOLOGY, 2000***
- **B.S./M.S. (4 years) in Mathematics, *UNIVERSITY OF BELGRADE, 1996***
- **B.S./M.S. (5 years) in Civil Engineering, *UNIVERSITY OF BELGRADE, 1994***

## Research Interests

- **Structural Health Monitoring (SHM) methods and strategies**
- **Fiber optic sensors and advanced sensing technologies**
- **SHM data management**

## Research Awards and Honors

- **Research on sensing sheets is referred to in the October issue of The Economist, 2016.**
- **Highly Commended Award, CIOB International Innovation and Research Awards, 2013**
- **The Structural Health Monitoring Person of the Year Award, by the editorial board of Structural Health Monitoring: An international Journal, 2013**