

**Department of Civil Engineering and Engineering Mechanics
Columbia University**



**Bayesian Logic Applied to Damage Assessment of a Smart
Precast Concrete Element**

Dr. Daniele Zonta

University of Trento

Host: Prof. Raimondo Betti

Today, fiber optics technology offers durable solutions for bridge monitoring, and recent advances in Micro Optical Electro Mechanical Systems (MOEMS) and wireless communications suggest that in the near future we will be able to rely on very small-scale optical devices. These innovations will radically change monitoring methods for civil structures in coming years, although industrial deployment is essential to overcoming the cost issue. In this light, the University of Trento is promoting research to develop construction systems for smart elements suitable for wide application to new bridge construction. These elements are precast Reinforced Concrete members embedding a sensing system and capable of self-diagnosis. Sensors are not just applied to the member but become an integral part of the prefabricated element, influencing its design criteria, performance and detailing. A major issue is how to exploit appropriately the large amount of measurements recorded by the system. The Bayesian logic provides a rational framework for interpreting measurement data while also allowing proper handling of all prior knowledge, including material properties, environmental conditions and sensor performance. This methodology allows to identify not only the most likely values of the unknown damage parameters (such as type, position and extent) but also their posterior probability distribution. This seminar introduces both the technological and the methodological aspects of the development and operation of these smart elements. Firstly, the design and development of reduced-scale prototypes of smart beam instrumented with fiber optic sensors are illustrated. Secondly, the ability of a Bayesian to update algorithms for identifying various states of structural damage, artificially produced in the laboratory, is demonstrated.

March 17, 2009 (Tuesday)

3:00 - 4:00 p.m.

Room 627, Mudd

<http://www.civil.columbia.edu/~ling/seminar>