

Baufakultät, Technikerstr. 13,  
Ort: HSB9  
**Thu 24 January 2008**  
Time: **16:30**

IfM Guest Lectures  
Prof. G. I. Schuëller

## Data Analysis for Structural Health Monitoring: the Strain Flexibility Based Method and the Bayesian Approach to Scenario Selection

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### Abstract

In Structural Health Monitoring, system identification is regarded as the process of recognizing the condition state of a structure using available measurements. The seminar presents two different approaches to perform this task.

In the first part, the strain flexibility based method will be illustrated: this is a deterministic tool to process modal parameters which proves to be very efficient in localizing damage, as strain is specifically related to local information. A formalization of the method will be provided, with a discussion on the mechanical conditions in which it can be correctly applied. The effectiveness of the method will be commented by using numerical and experimental examples.

The second part is devoted to introduce an approach based on Bayesian model selection. This is a far richer and more general framework based on probabilistic theory, which allows proper handling of all prior knowledge, including material properties, environmental conditions and sensor performance. The methodology enables us identify not only the most likely values of the unknown damage parameters (such as type, position and extent) but also their posterior probability distribution. Particularly, a two-steps algorithm will be illustrated, which relies on the distinction between instantaneous and long-term contributions in the structural response. The main drawback of the Bayesian approach is the high computational demand: to circumvent this issue both Monte Carlo and deterministic numerical techniques will be introduced and discussed. The method is validated by numerical, experimental and in-situ examples.



### Author details

- **Education:**  
Laurea in Civil Engineering (2003), University of Trento, Italy  
Doctoral degree in Structural Mechanics (2007), University of Trento, Italy
- **Research Areas:**  
Structural Health Monitoring  
Bayesian Probabilistic Theory  
Dynamics of Structures  
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