1st workshop Cost Action TU1402

WG2: SHM technologies and structural performance

Copenhagen, May 4-5, 2015

POLITECNICO DI MILANO





THE INTERPOLATION METHOD FOR THE DETECTION OF LOCALIZED STIFFNESS LOSSES

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* Department ABC

Architecture, **B**uilt environment and **C**onstruction engineering

Summary of research group activity

Research topics related to WG2

The group is mainly involved in **Vibration based Damage Localization** with a focus on **Civil structures**: Multistorey Buildings, Bridges, Cultural heritage.
Specifically the group is currently working on a **damage identification algorithm** for the **localization of stiffness losses** in structures instrumented with network of sensors, basing on their response (acceleration or displacement) to vibrations.

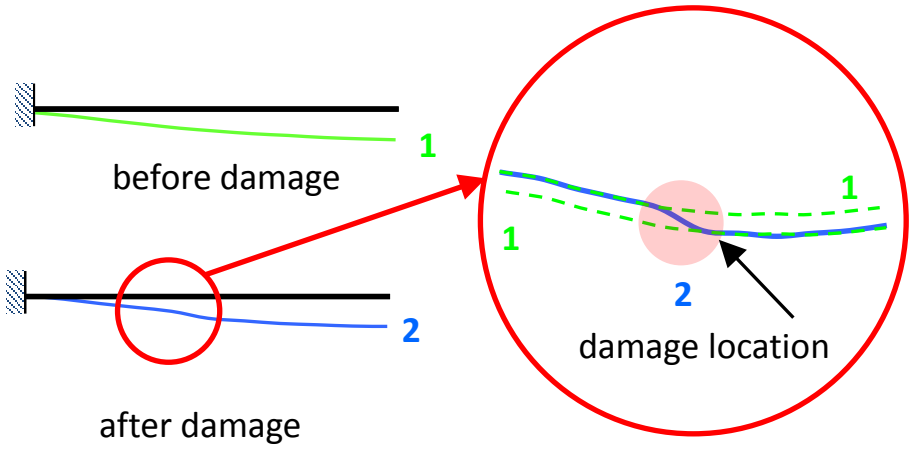
Research group at POLIMI

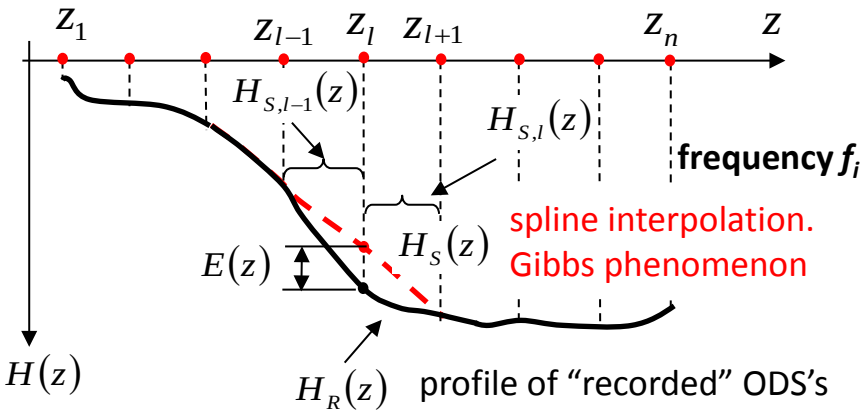
Maria Pina Limongelli	Associate Professor
Luca Martinelli	Assistant Professor
Giorgio Busca	Assistant Professor
Marco Domaneschi	Research associate
Alessandra Zambrano	Research associate
Arianna Gecchelin	PhD student

National and international collaborations

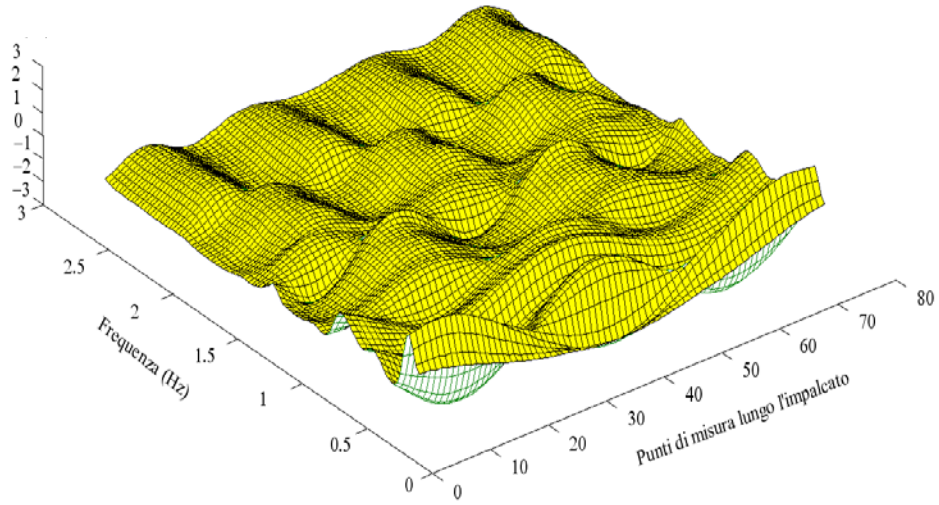
University of Udine	(Italy)
IFSTTAR/COSYS/LISIS	(France)

IDDM: Interpolation Damage Detection Method



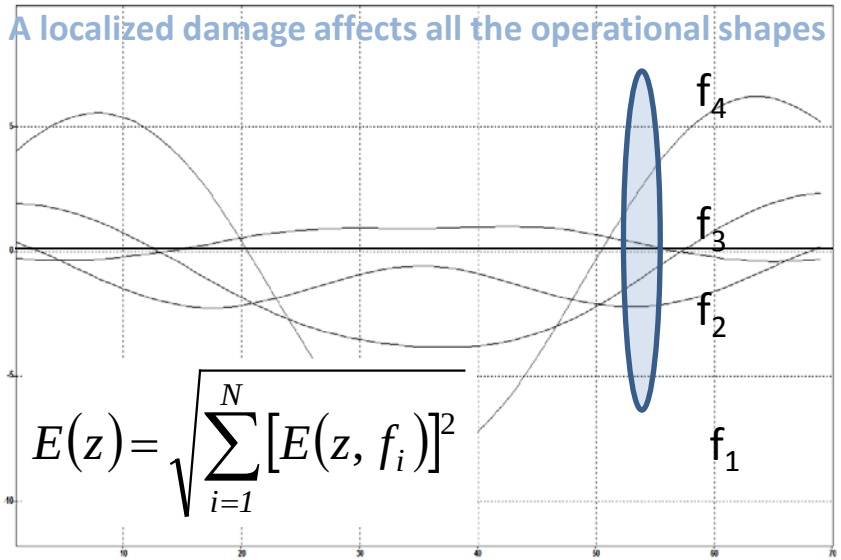


$$E(z, f_i) = \left| ODS_R(z, f_i) - ODS_S(z, f_i) \right|$$



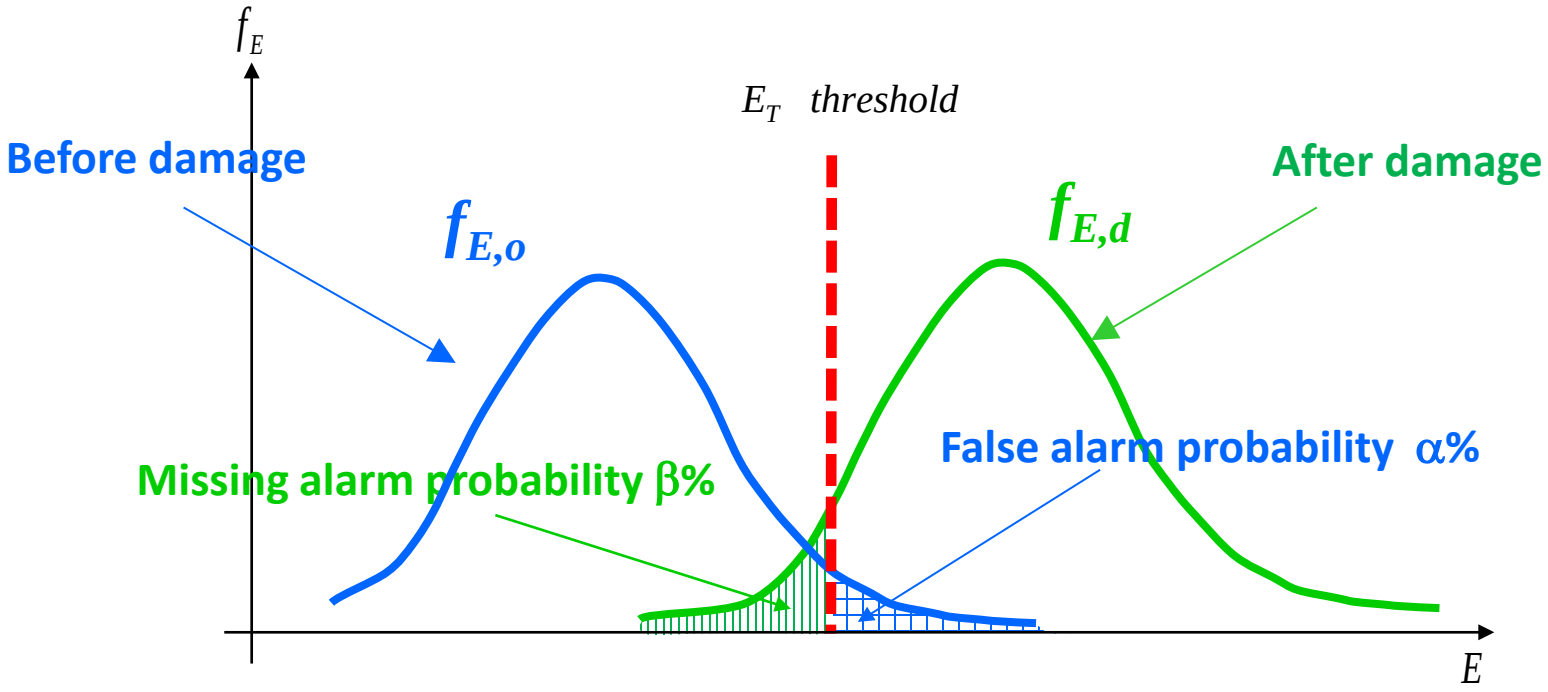
normalization of ODSs

A localized damage affects all the operational shapes



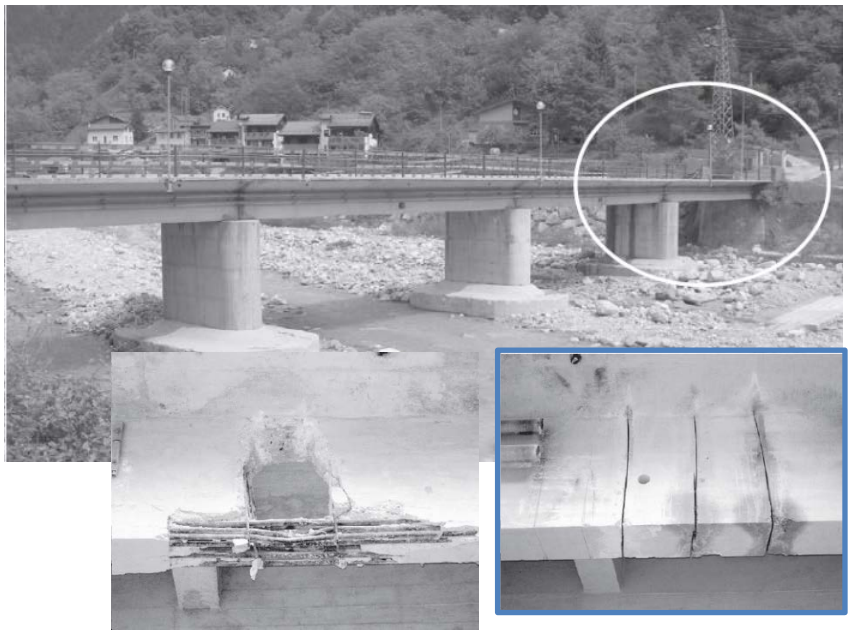
$$E(z) = \sqrt{\sum_{i=1}^{N} \left[E(z, f_i) \right]^2}$$

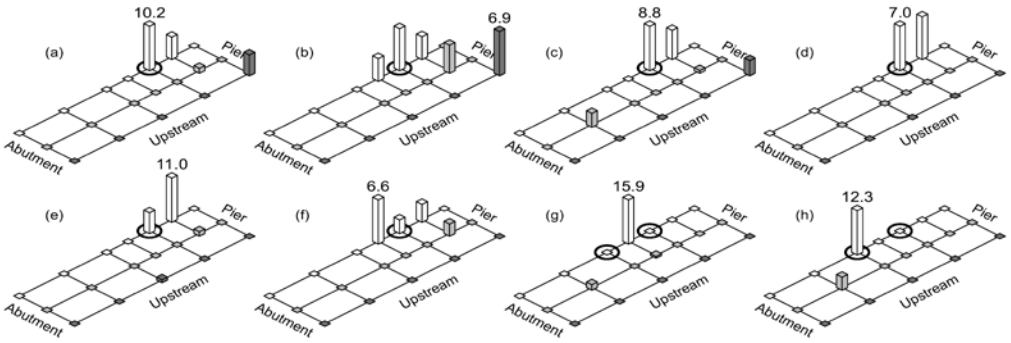
Should we stay or should we warn?



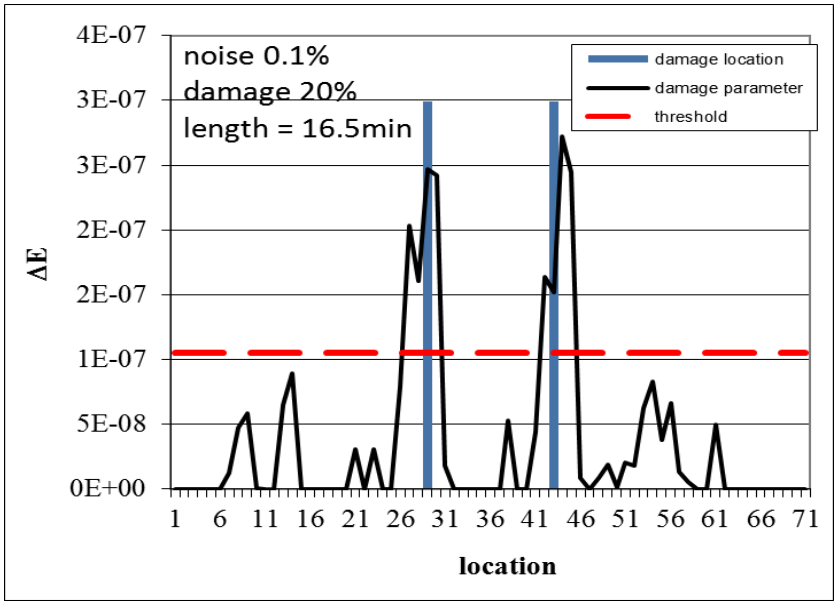
1. $f_{E,o}$ **and** $f_{E,d}$ **known** — Long term monitoring: ambient
2. $f_{E,o}$ **known and** $f_{E,d}$ **unknown** — Periodical monitoring: prompt alert
3. $f_{E,o}$ **and** $f_{E,d}$ **unknown** — Short monitoring: vibration tests

Short monitoring



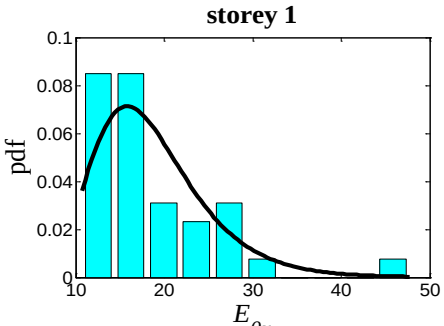


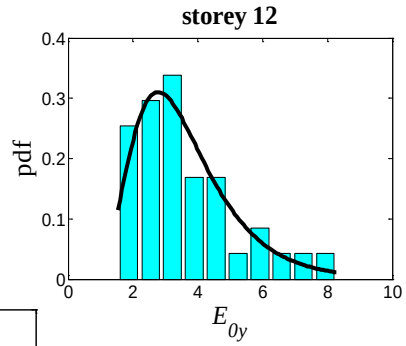
Dogna bridge – Valdogna. Italy

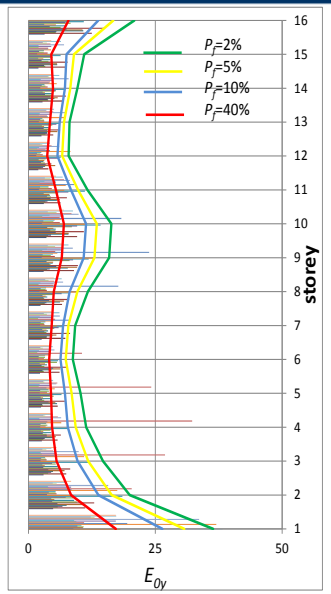


Shimotsui-Seto suspension bridge Honshū- Japan

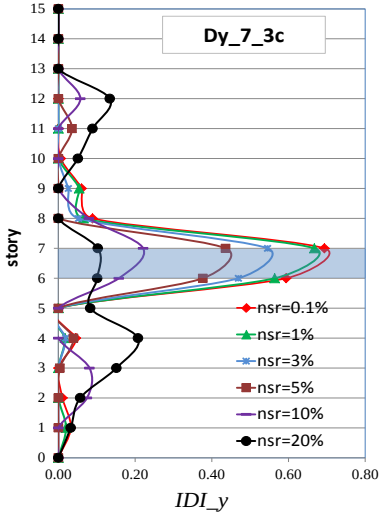
Periodical monitoring – prompt alert

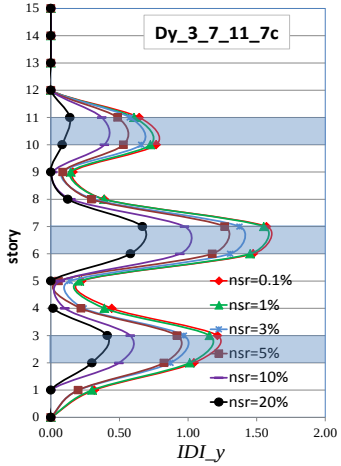


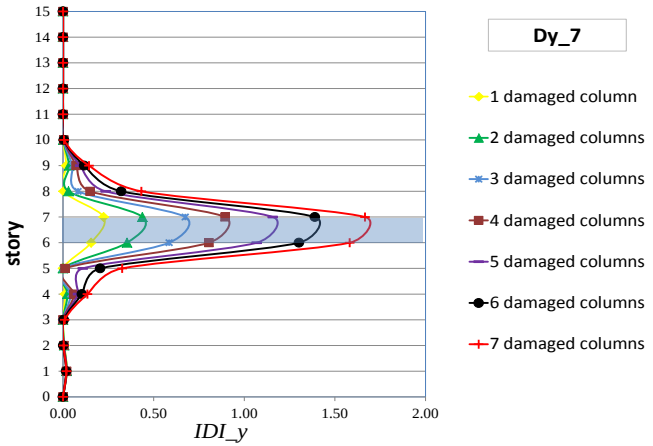




Factor Building UCLA. Monitored by USGS (US Geological Survey)







Wish list

Data recorded on a structure before and after damage…
…several scenarios…several sensors
Living lab for researchers and industrials (innovation?)

Cost model to define the threshold

Model structural performance to estimate life cycle benefits B_1 and B_0