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In collaboration with the Technical University of Munich, Rhine-Westphalia Institute of Technology Aachen, University of Florence, University of Catania and University of Minho. Funded by the DAAD program "Hochschuldialog mit Südeuropa" Giresini, L. and Taddei, F.; (Eds.) 2017, Pisa

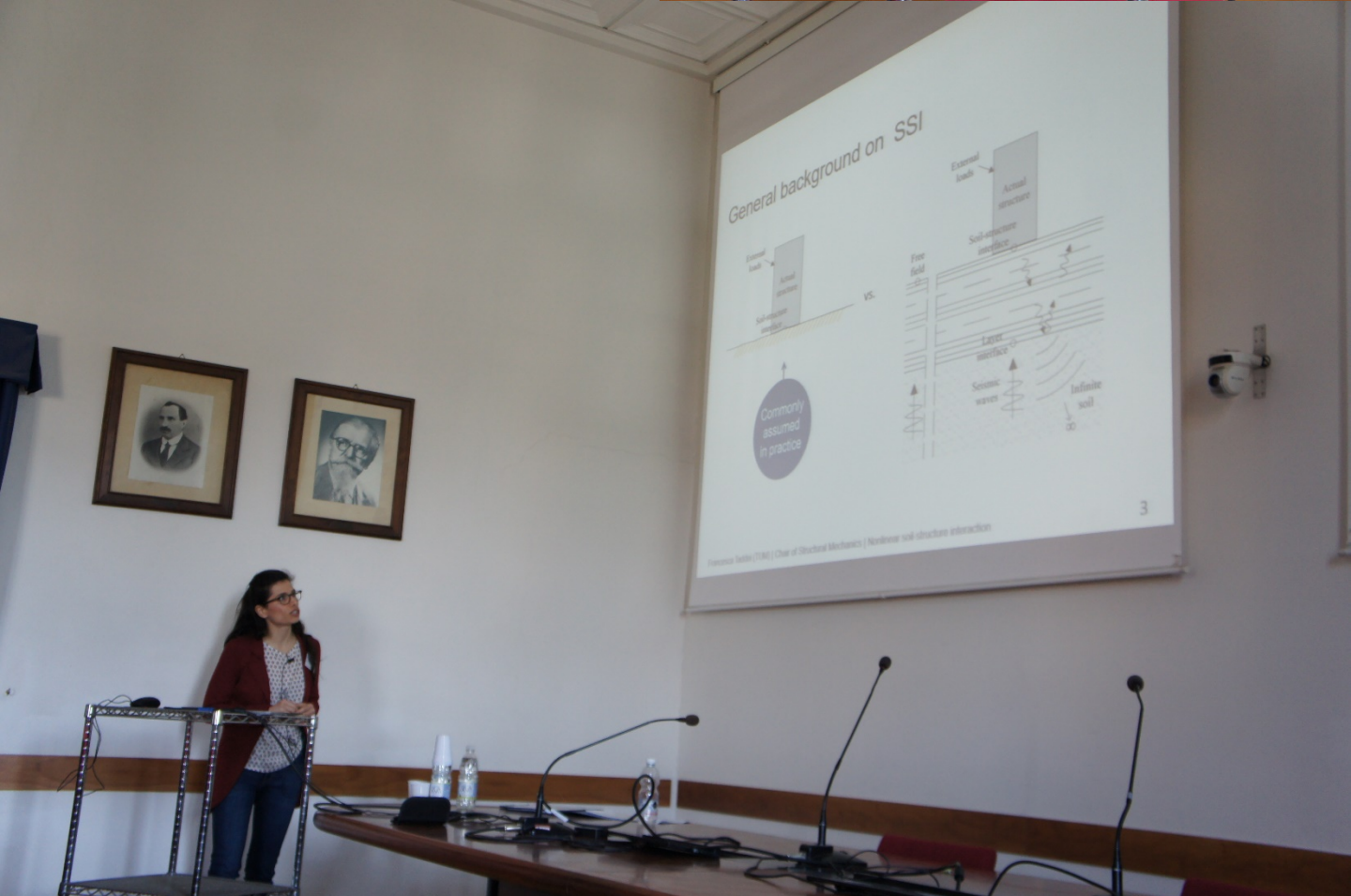
The contributions will be published in the International Journal *Buildings* (MDPI)











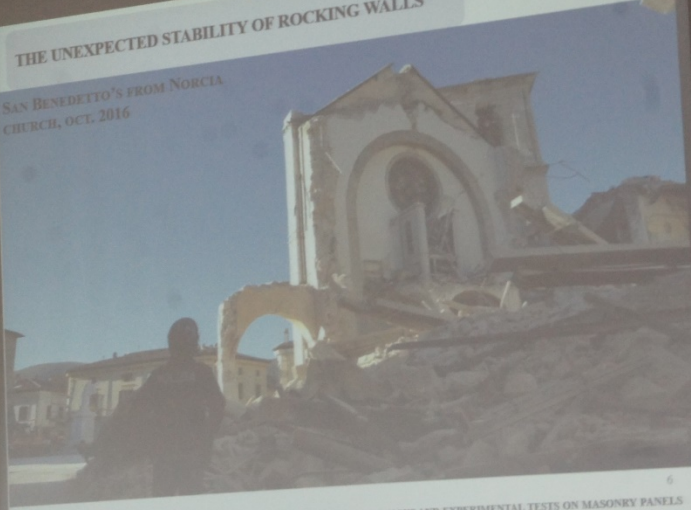






# THE UNEXPECTED STABILITY OF ROCKING WALLS

SAN BENEDETTO'S FROM NORCIA  
CHURCH, OCT. 2016



ROCKING ANALYSIS OF FREE AND RESTRAINED STRUCTURES: THEORY, APPLICATIONS AND EXPERIMENTAL TESTS ON MASONRY PANELS  
UNIVERSITY OF PISA - 16<sup>TH</sup> 18<sup>TH</sup> MARCH 2017 TIASD 2017  
LINDA GIRESENI



2nd International Workshop on  
Traditional and Innovative Approaches  
in Seismic Design (TIASD)

Università di Pisa

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DESTEC

Dipartimento di Ingegneria dell'Energia, dei Sistemi, del Territorio e delle Costruzioni

16<sup>th</sup>, 2017

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Model Order Reduction (MOR)  
General Idea - Monkey Analogy



M. Buchschiem, R. Rodríguez-Sánchez, G. Müller | MOR: Application for Seismic Analysis | Workshop TIASD 2017 4

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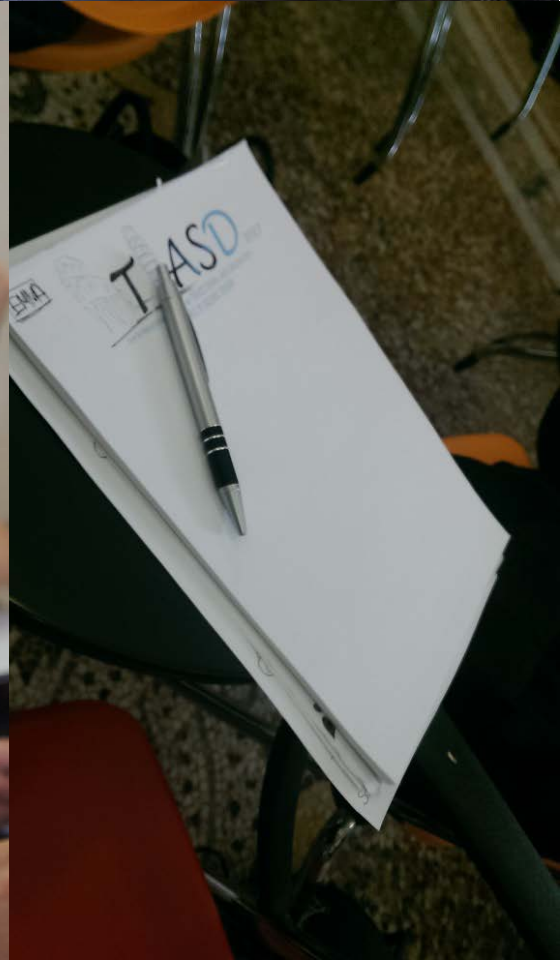












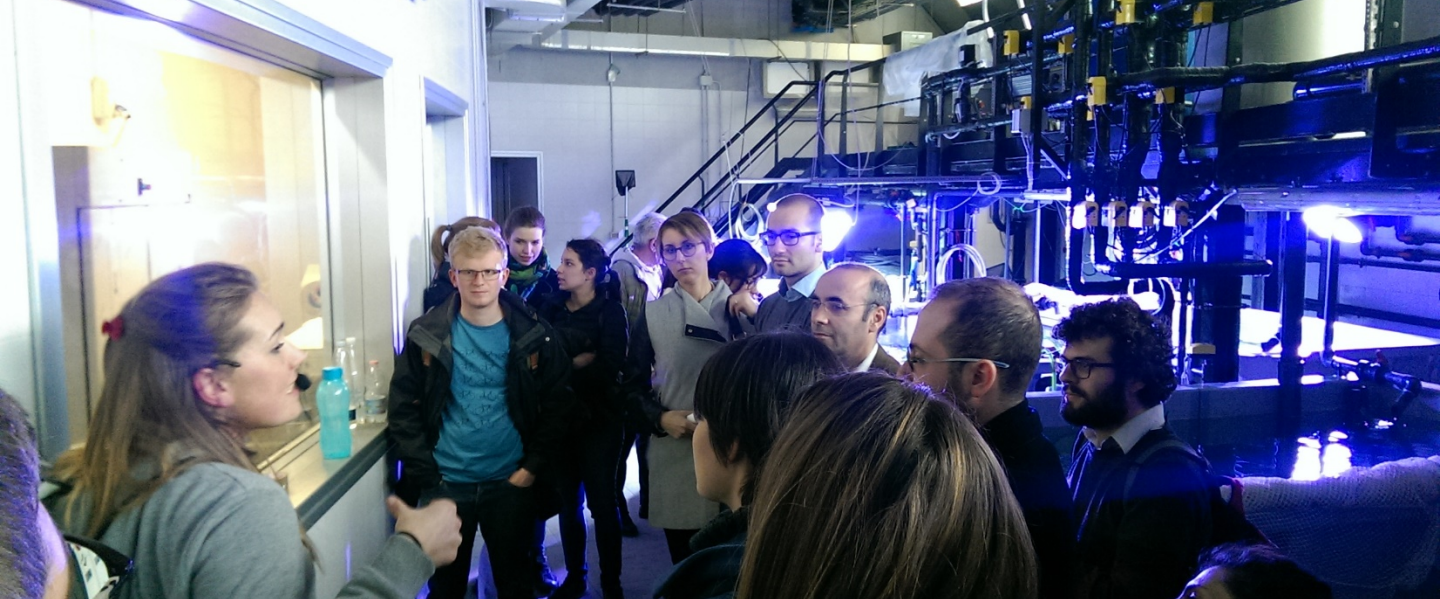














## FEM + ...

...Absorbing Boundary Conditions  
[Grote 2000]

...Perfectly Matched Layers  
[Rammerstorfer 2006]

...Thin Layer Method  
[Weas 1972]

...Boundary Element Method  
[Gaul et al. 2003]

...Scaled Boundary Finite Element Method  
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116

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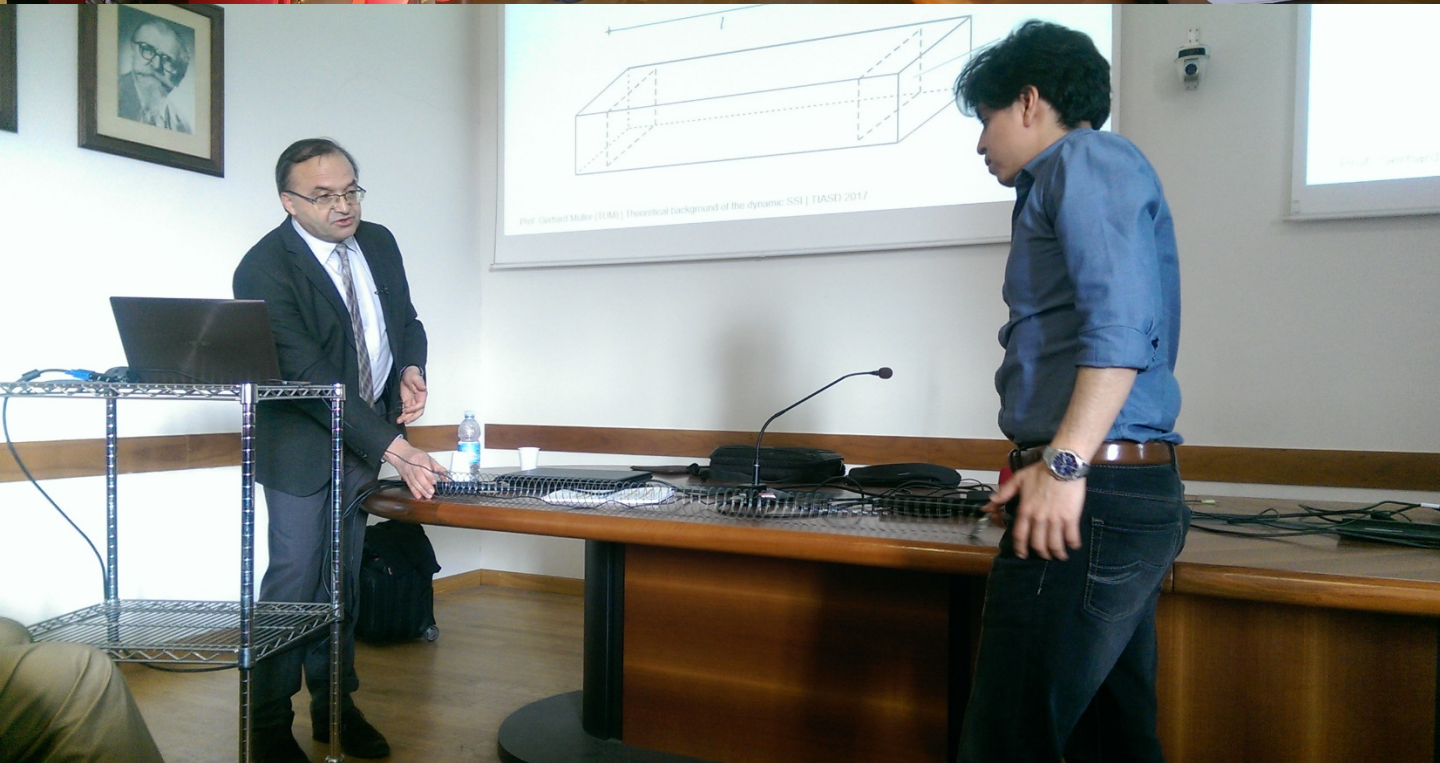
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115















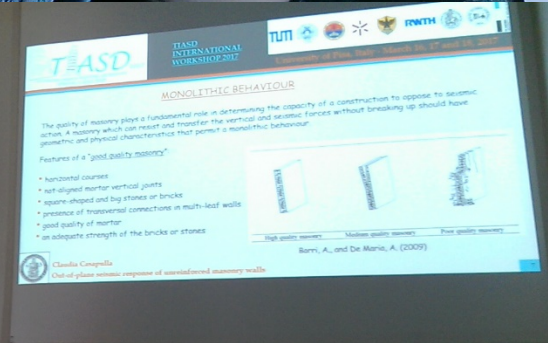
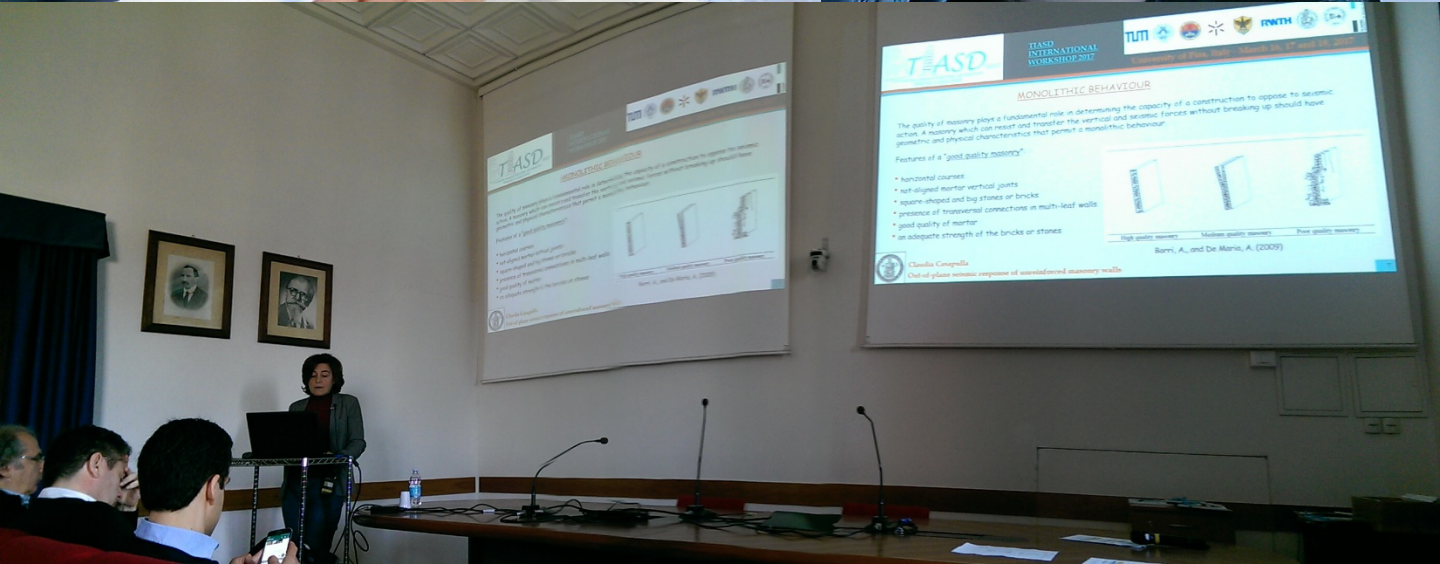





























UNIVERSITÄ  
DEGLI STUDI  
FIRENZE

SEISMIC BEHAVIOR  
OF RC BUILDINGS

## PLAN-IRREGULAR STRUCTURES

### KEY PARAMETERS (straightforward definition for a one-storey building)

**Uncoupled natural period**  $T_x = 2\pi \sqrt{\frac{m}{K}}$

**Stiffness eccentricity**  $e_{sx} = \frac{1}{L} \sum_{i=1}^N k_{yi} x_i$

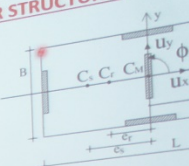
**Torsional stiffness**

$$I_{p,k} = \sum_{i=1}^N \left[ k_{yi} (x_{i,C_r})^2 + k_{xi} (y_{i,C_r})^2 \right]$$

**Force reduction factor**

**Torsional strength**

$$I_{p,f} = \sum_{i=1}^N \left[ F_{yi} (x_{i,C_r})^2 + F_{xi} (y_{i,C_r})^2 \right]$$



**Stiffness radius of gyration**

$$d_s = \frac{1}{\rho L} \sqrt{\frac{I_{p,k}}{K}}$$

$d_s > 1$  torsional  
 $d_s < 1$  torsionally

**Strength eccentricity**  $e_{rx} = \frac{1}{L} \sum_{i=1}^N \frac{F_{xi}}{F}$

**Strength radius of gyration**

$$d_r = \frac{1}{\rho L} \sqrt{\frac{I_{p,f}}{F}}$$

$d_r > 1$  torsional  
 $d_s < 1$  torsionally

Prof. Mario De Stefano













Waiting for the 3<sup>rd</sup> International Workshop Traditional and Innovative Approaches in Seismic Design 2017 in Guimaraes...