

Research Overview Non Destructive Testing

Ljubljana, SLO

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Agenda

- Mission
- Damage Localization
- Permanent Monitoring Site „Reichsbrücke“
 - Measurement concept
 - Temperature influence
 - Safety Index
- Wireless Sensor Networks
- Conclusion



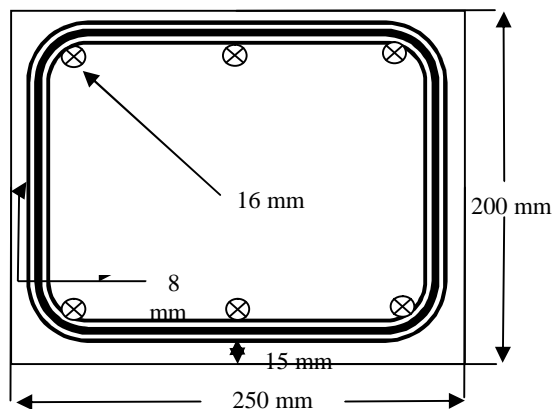
Mission

- Research and development for *Advanced Infrastructure Maintenance Monitoring and Simulation* to reduce *Life Cycle Costs* and increase structural *Reliability* and *Safety*

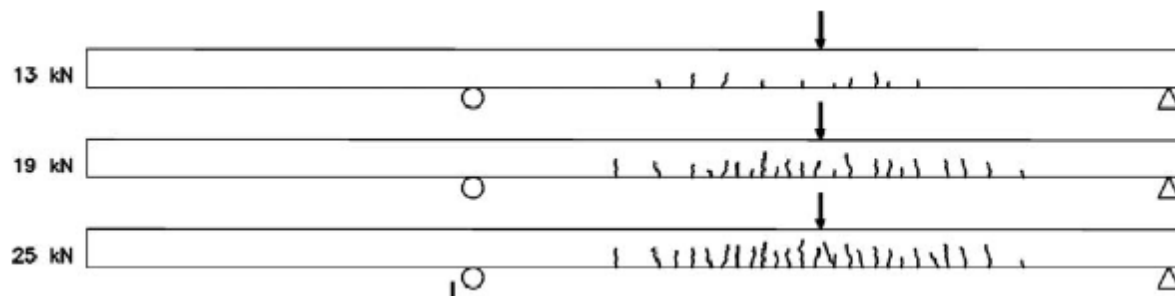


Damage localization with computational model updating (1)

- Damaged experimental beam (KUL Leuven)

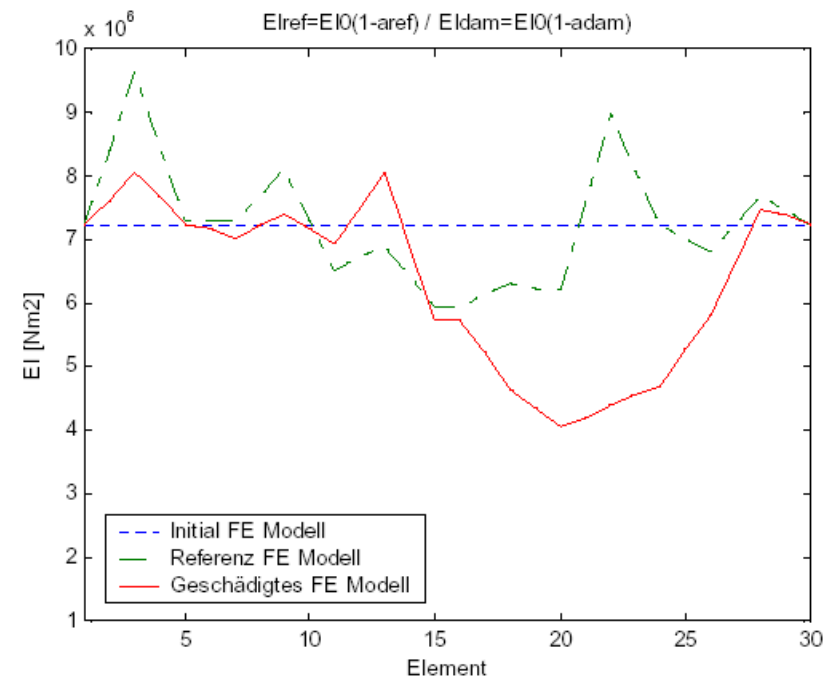
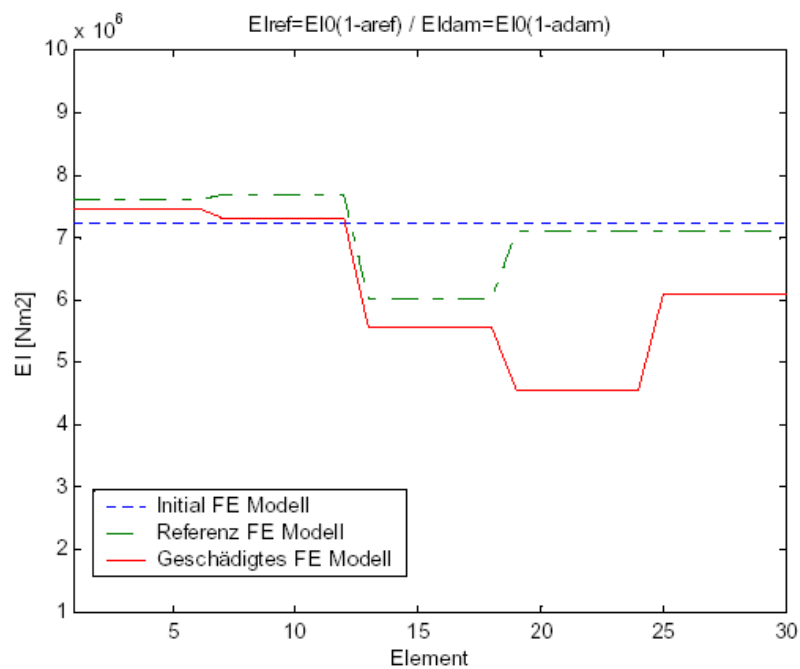


Natural frequencies	
reference	damaged
22.02 Hz	19.35 Hz
63.44 Hz	56.90 Hz
123.27 Hz	111.64 Hz
201.92 Hz	185.22 Hz



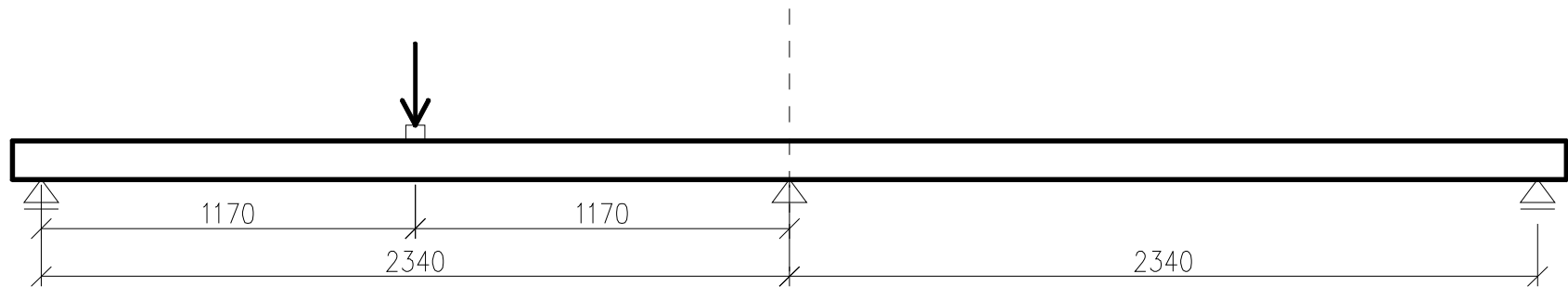
Damage localization with computational model updating (1)

- Identification with iterative optimisation

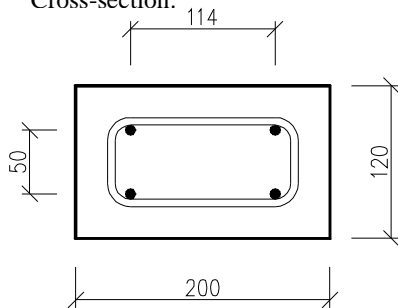


Damage localization with computational model updating (2)

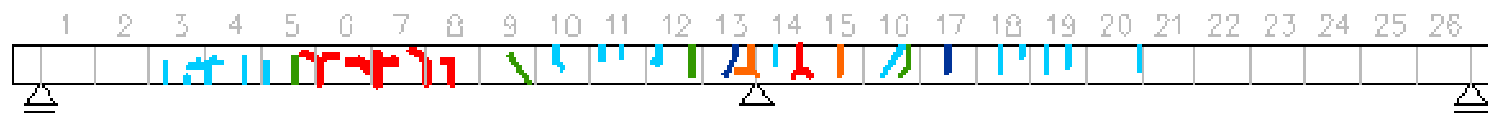
- Vibration measurements (5-8 measuring points)



Cross-section:



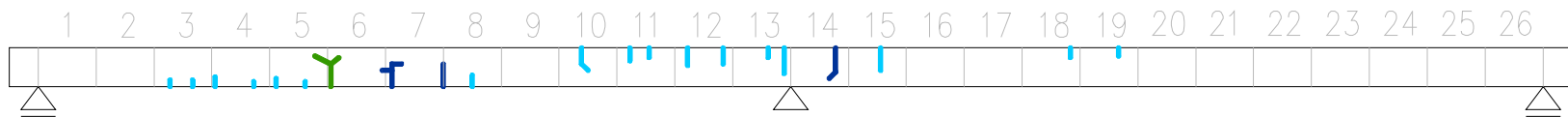
Damage localization with computational model updating (2)



Legend:

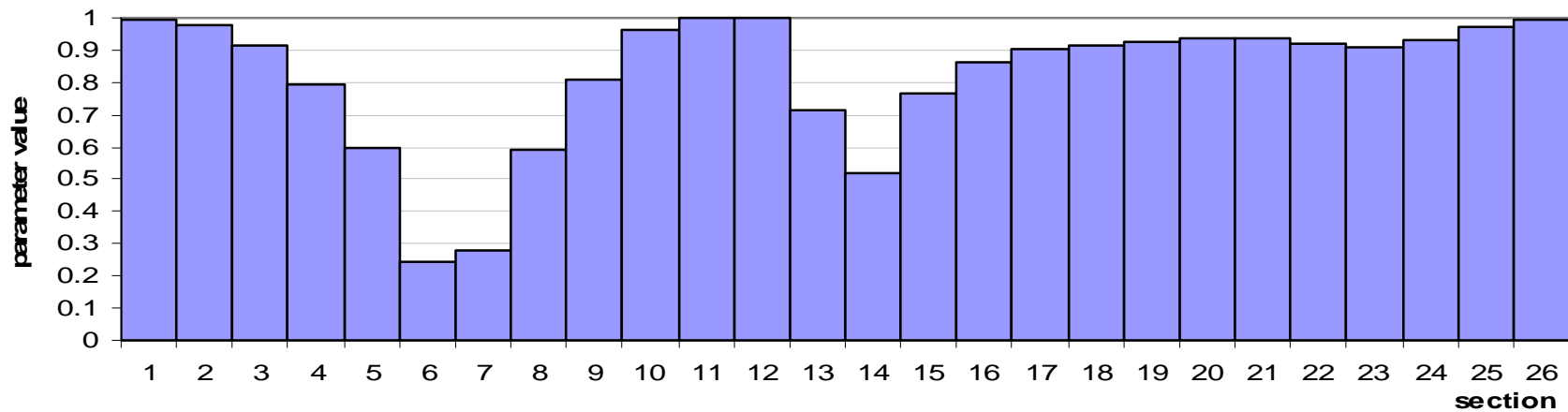
XX section number	— crack 0.2 mm	— crack 0.4 mm	— crack 2 mm
— crack 0.1 mm	— crack 0.3 mm	— crack 0.5-0.6 mm	

Damage localization with computational model updating (2)



Legend: XX section number

- crack 0.1 mm
- crack 0.2 mm
- crack 0.3 mm
- crack 0.4 mm
- crack 0.5 mm

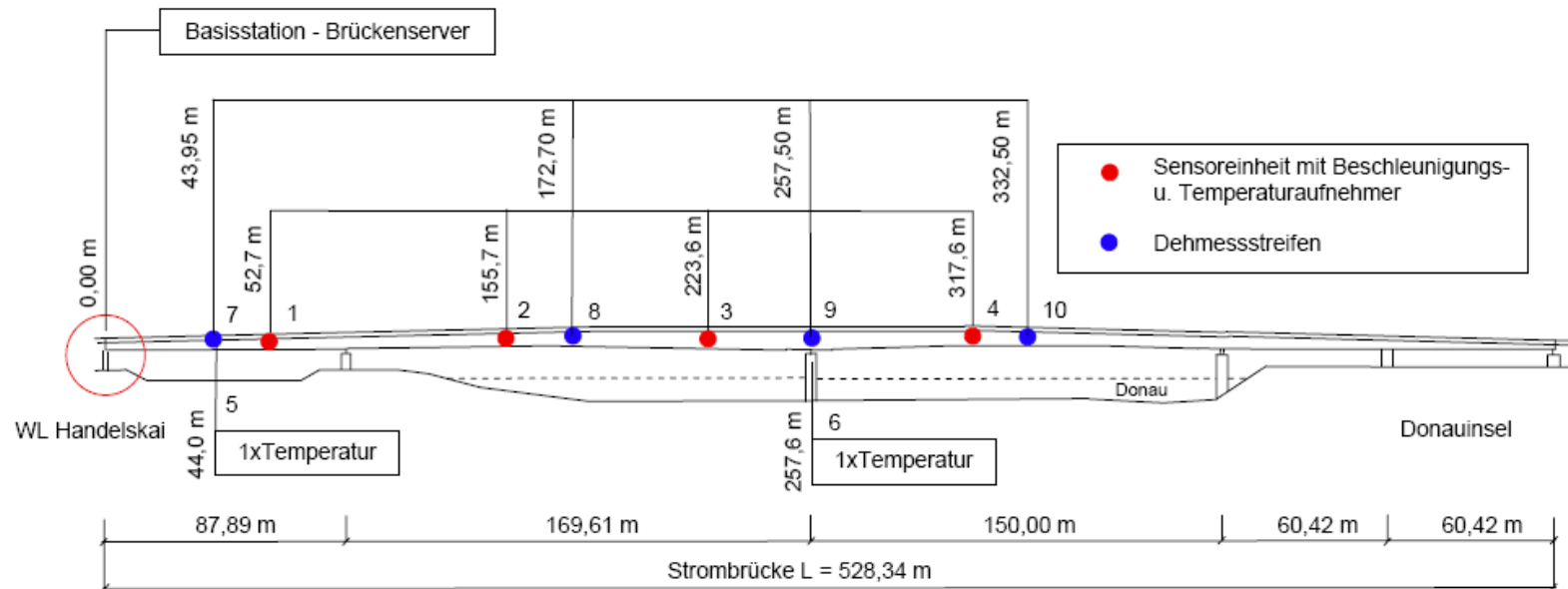


Permanent Monitoring System - Vienna "Reichsbrücke"

- Permanent vibration monitoring data since 2005
- Combined road and subway bridge
 - 6 lanes
 - 2 subway (in the box girder)
 - Rehabilitation 2003 - 2005
- 4 accelerometers (3D), temperature sensors, strain gauges and web cam

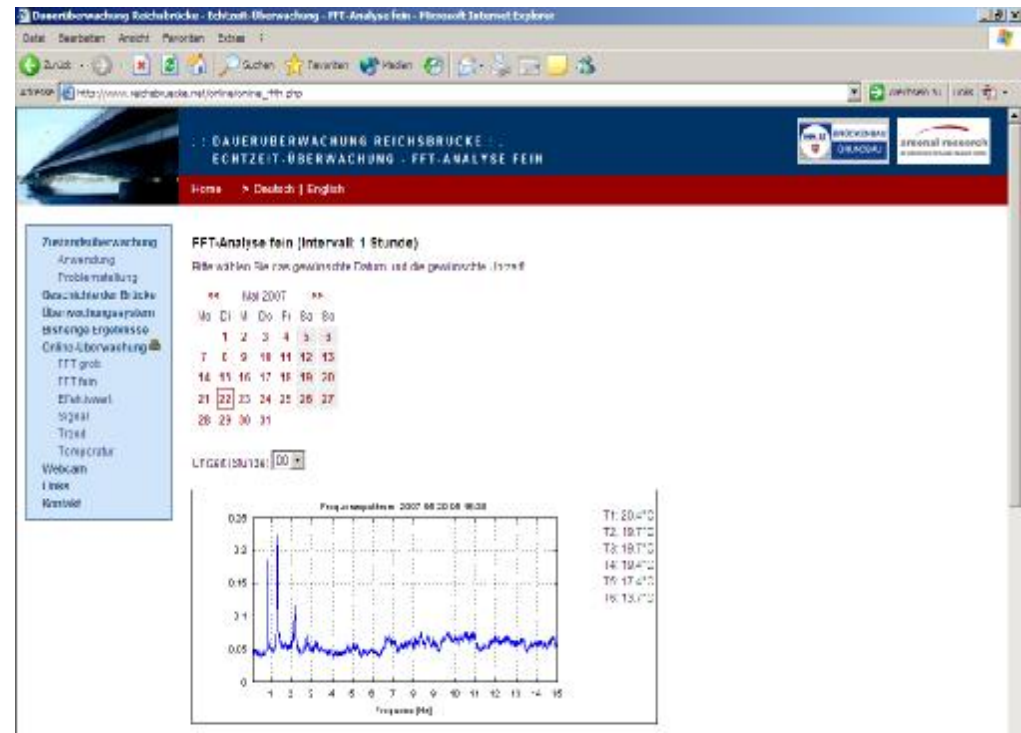


Measurement Concept



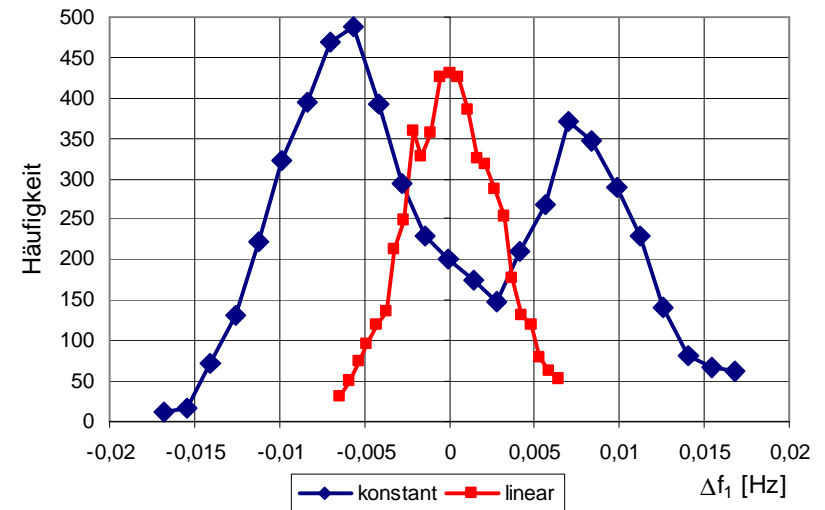
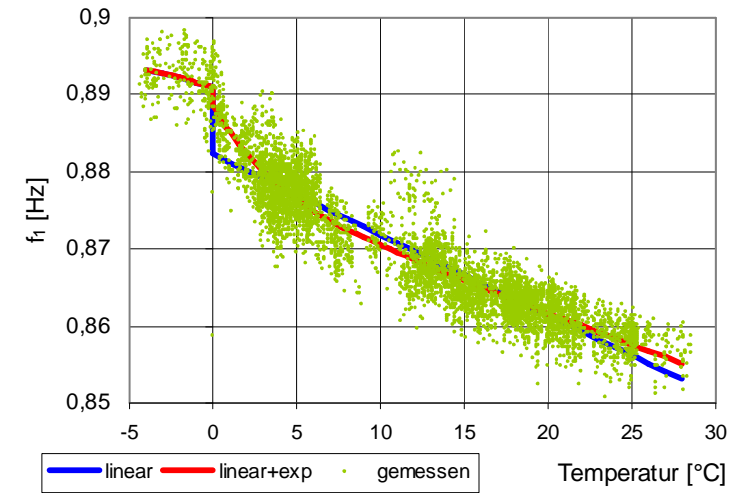
Structural health monitoring and web interface

- Real time signal analysis
 - Time domain
 - Fast Fourier Transformation
 - RMS-values
 - Temperature plot
 - Web cam
- Web Interface
www.reichsbruecke.net



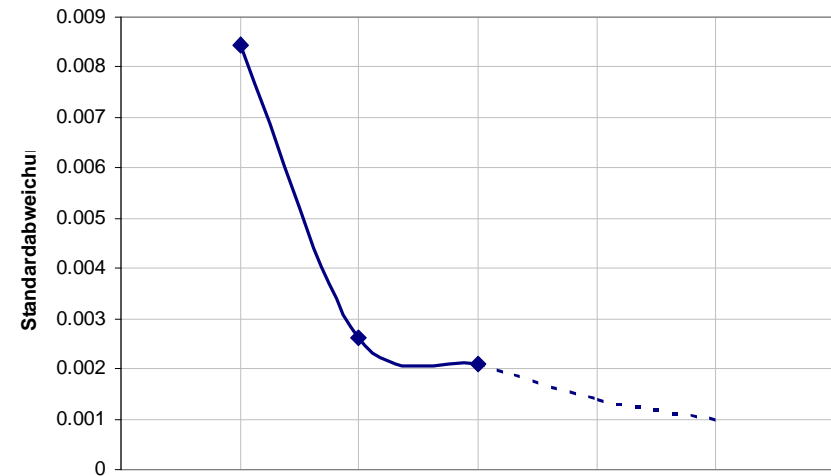
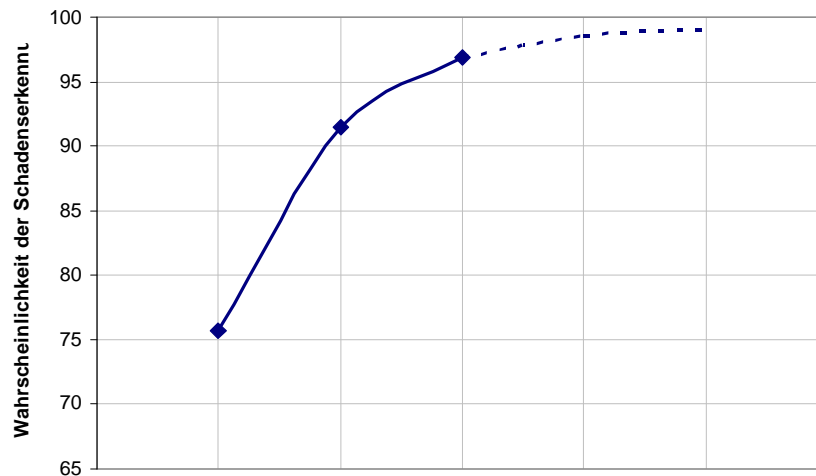
Temperature models

- Automatic analysis of 1 year data
- Fitting different models
(linear, linear+exp)
- Standard deviation
 - constant temperature [blue]
 - linear temperature model [rot]



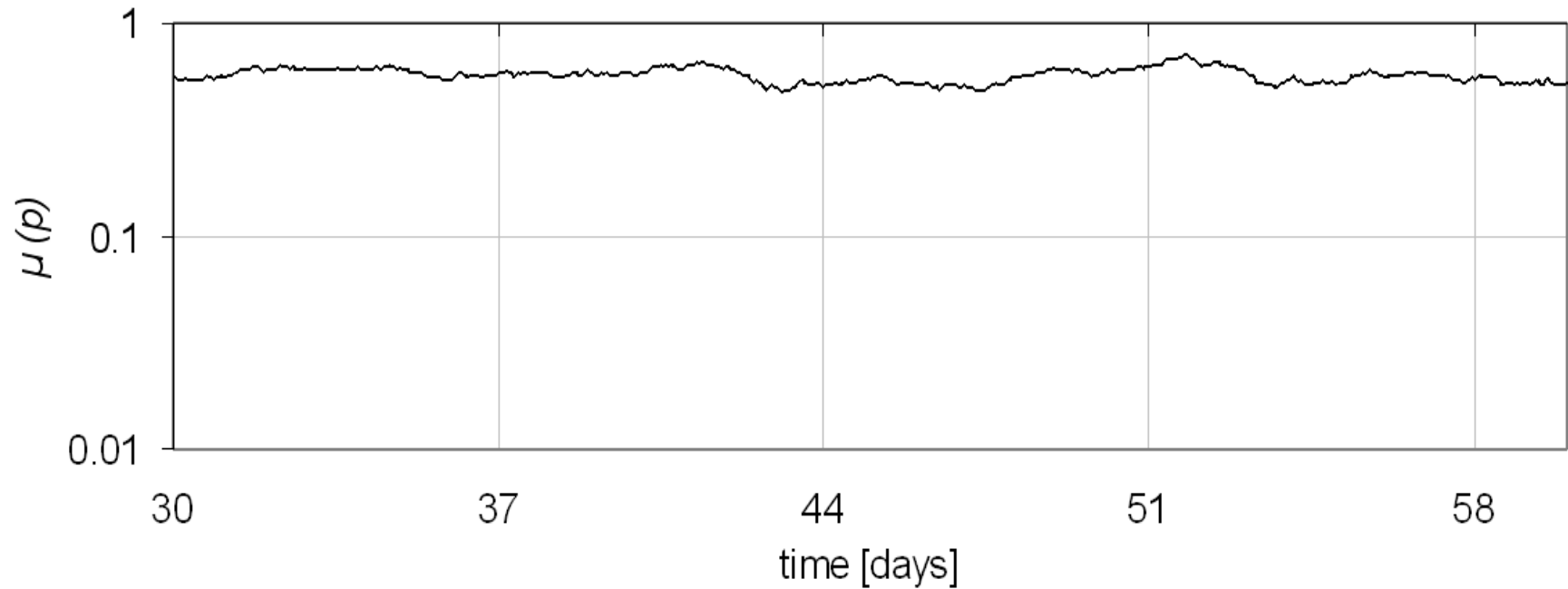
Further developments and improvement

The knowledge of influencing and bias parameters will improve the identification probability significant



Damage areas and scenarios (FE-Simulation)

➤ Safety Index

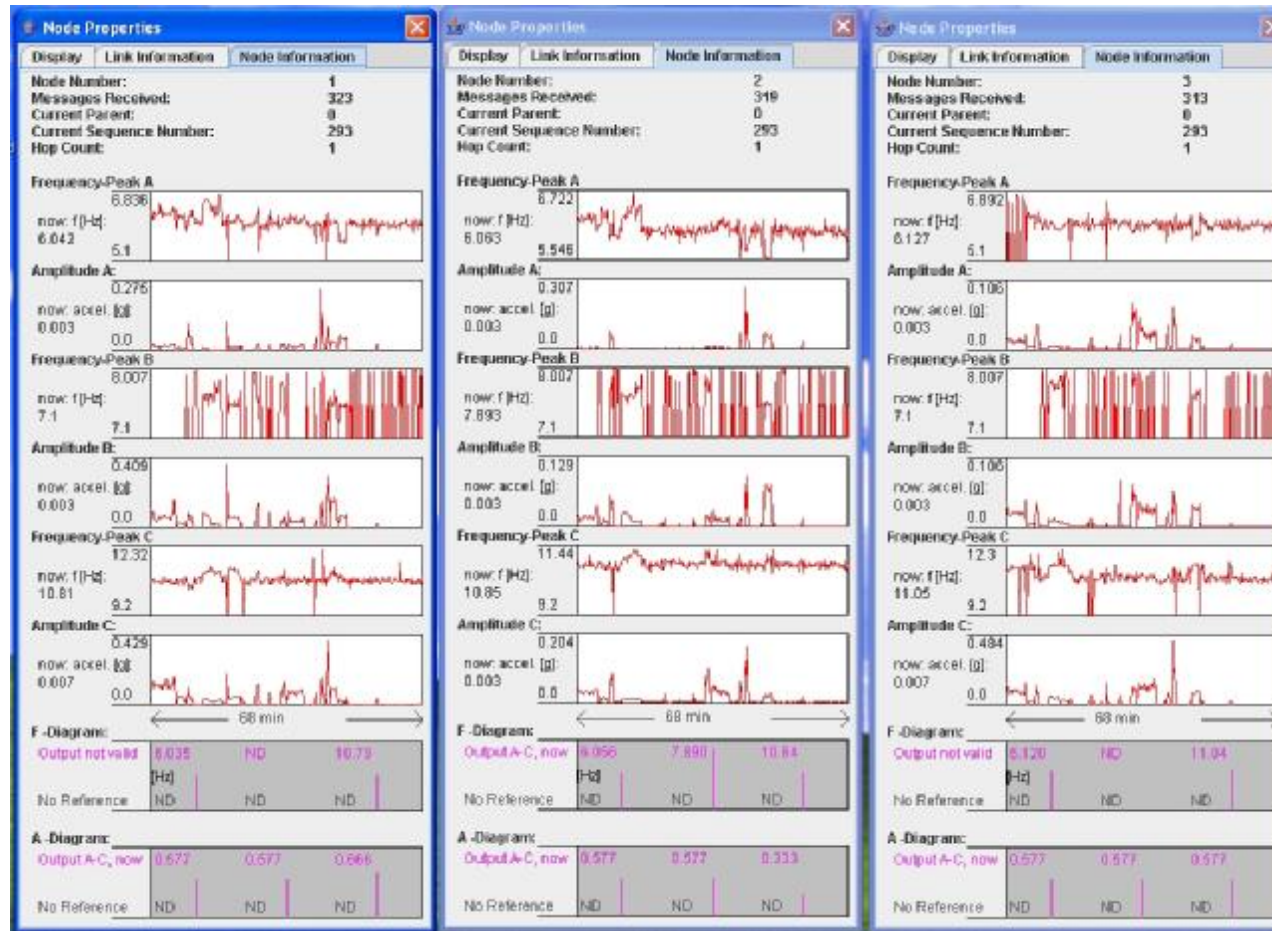


Wireless Sensor Networks

- Implementing models and algorithms for structural health monitoring on MOTES
- Based on tinyOS and nesC
- Reducing costs and enhancing deployment



Demonstration



Acknowledgment

- The **municipal authority of Vienna** for the good cooperation in the vibration based monitoring projects referring to the Reichsbrücke
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- **Industrial and research partners** of arsenal research