

Intelligent Sensing for Infrastructure Management

Prakash Kripakaran

University of Exeter

Sensing Technology



Tsing Ma bridge, Hong Kong



St. Anthony falls bridge, Minnesota

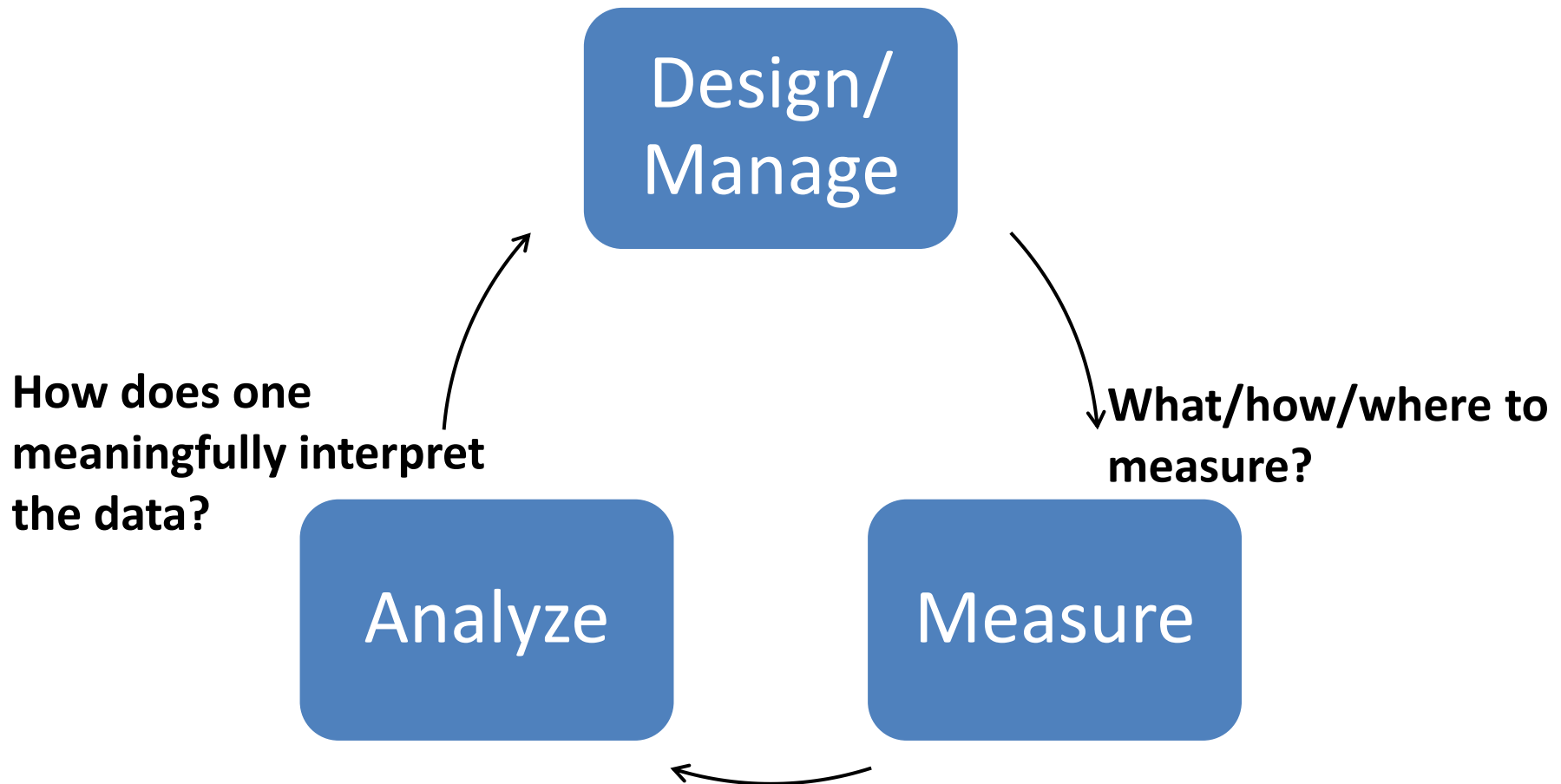
Bridges equipped with hundreds of sensors with the aim of real-time monitoring of structural performance

RAEng report on Smart Infrastructure -

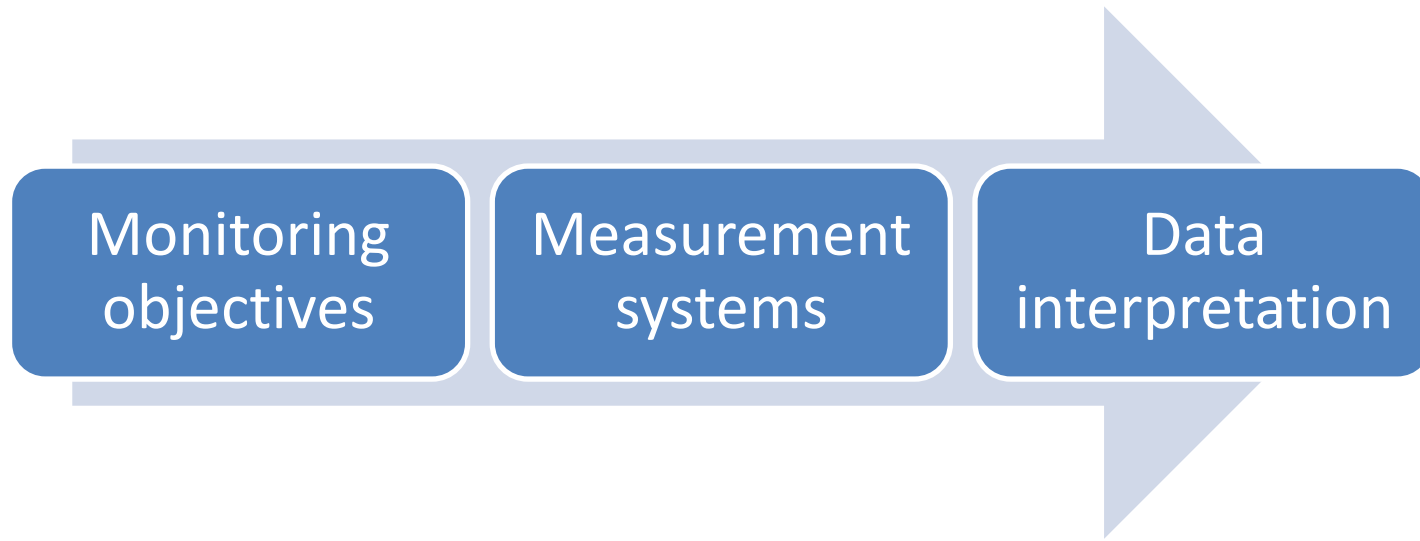
“A smart system uses a feedback loop of data, which provides evidence for informed decision-making. The system can monitor, measure, analyse, communicate and act, based on information captured from sensors. Different levels of smart systems exist. A system may:

- collect usage and performance data to help future designers to produce the next, more efficient version*
- collect data, process them and present information to help a human operator to take decisions*
- use collected data to take action without human intervention”*

Smart Infrastructures



Measurement Challenges



Indirect measurements => inverse problems

Research focus: Relate design of measurement systems to data interpretation techniques.

Data Interpretation Process



Data interpretation techniques can be classified into model-based or data-driven methods

*Research focus: **Multi-level data fusion models for combining and analyzing heterogeneous measurement sets for performance evaluation***

Langensand bridge, Luzern

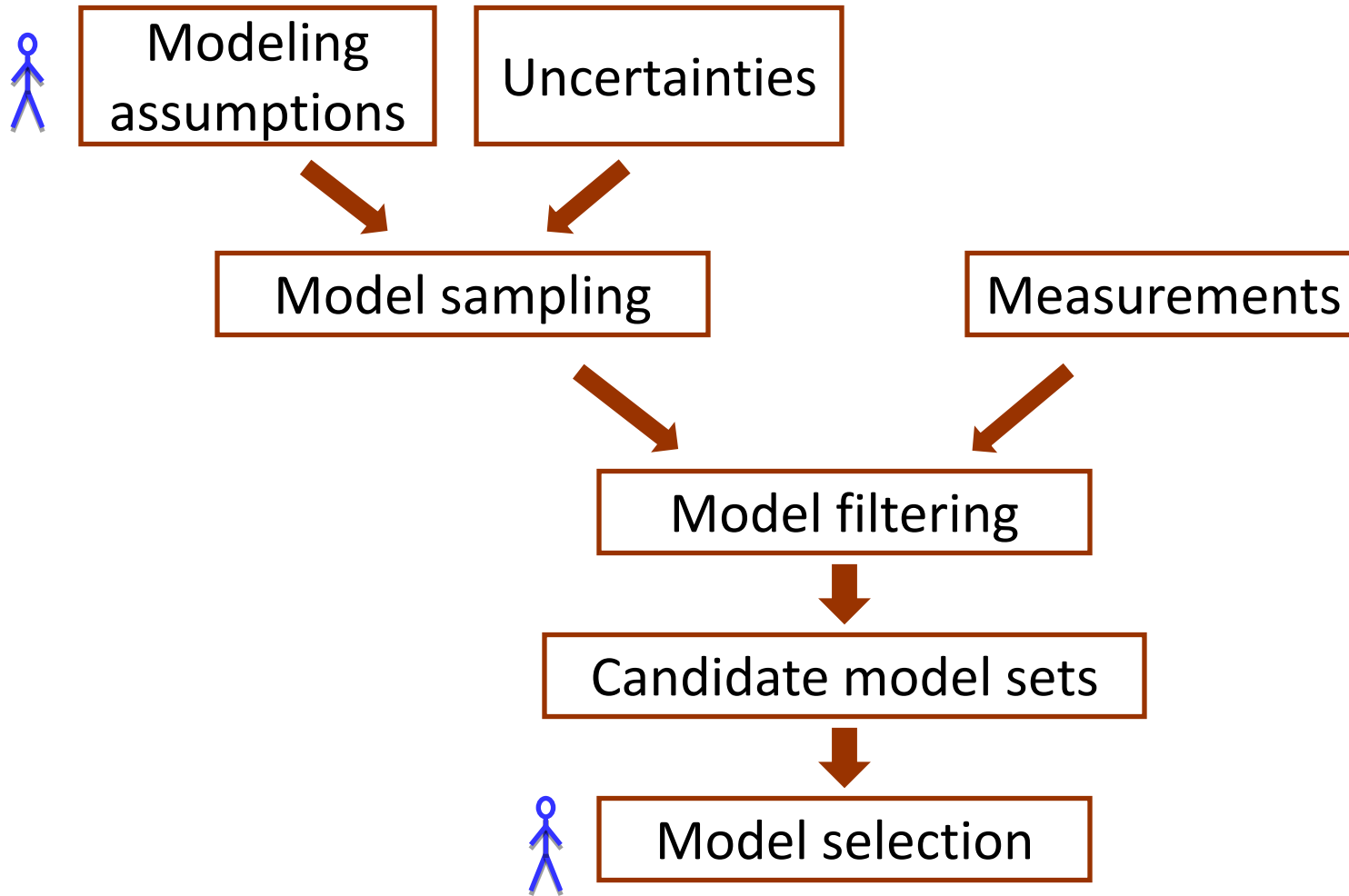
Langensand bridge, Luzern

Span: 80 m, Composite bridge (steel-concrete)

**Deflection requirements governed the design.
(Research undertaken while at EPFL)**

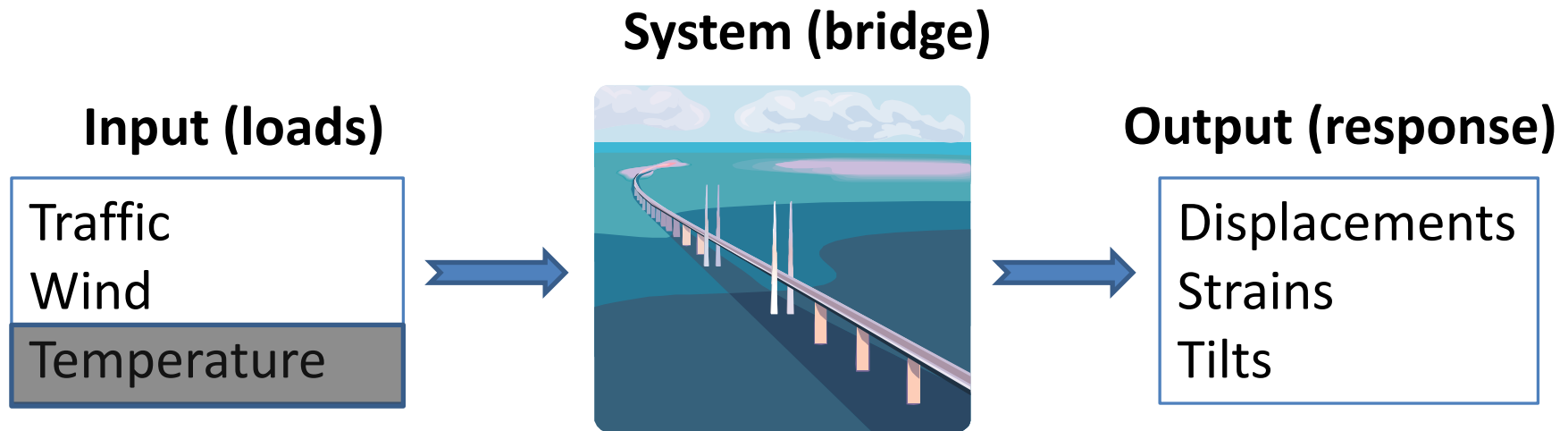


Model-based methods



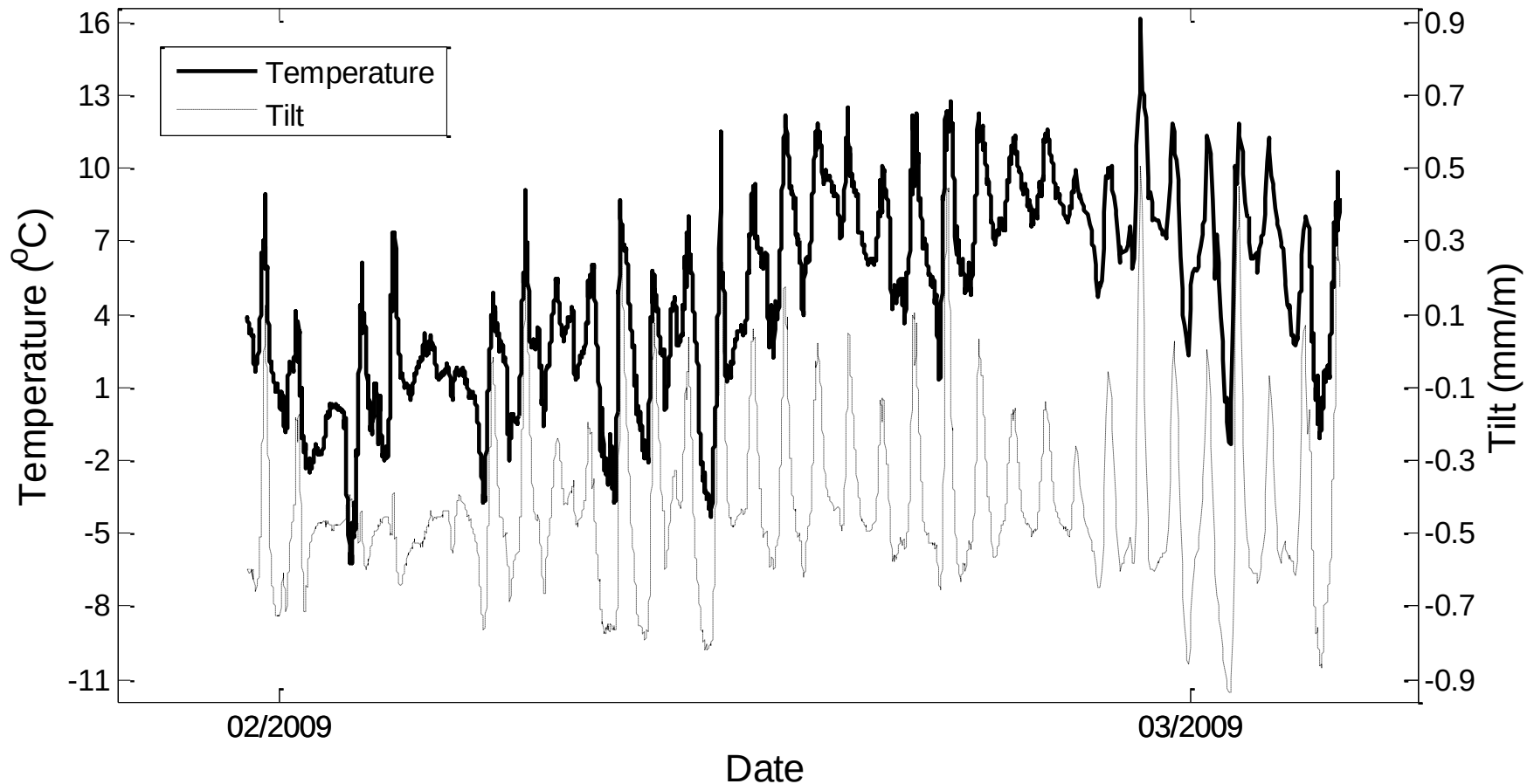
Continuous monitoring

Temperature & Bridges



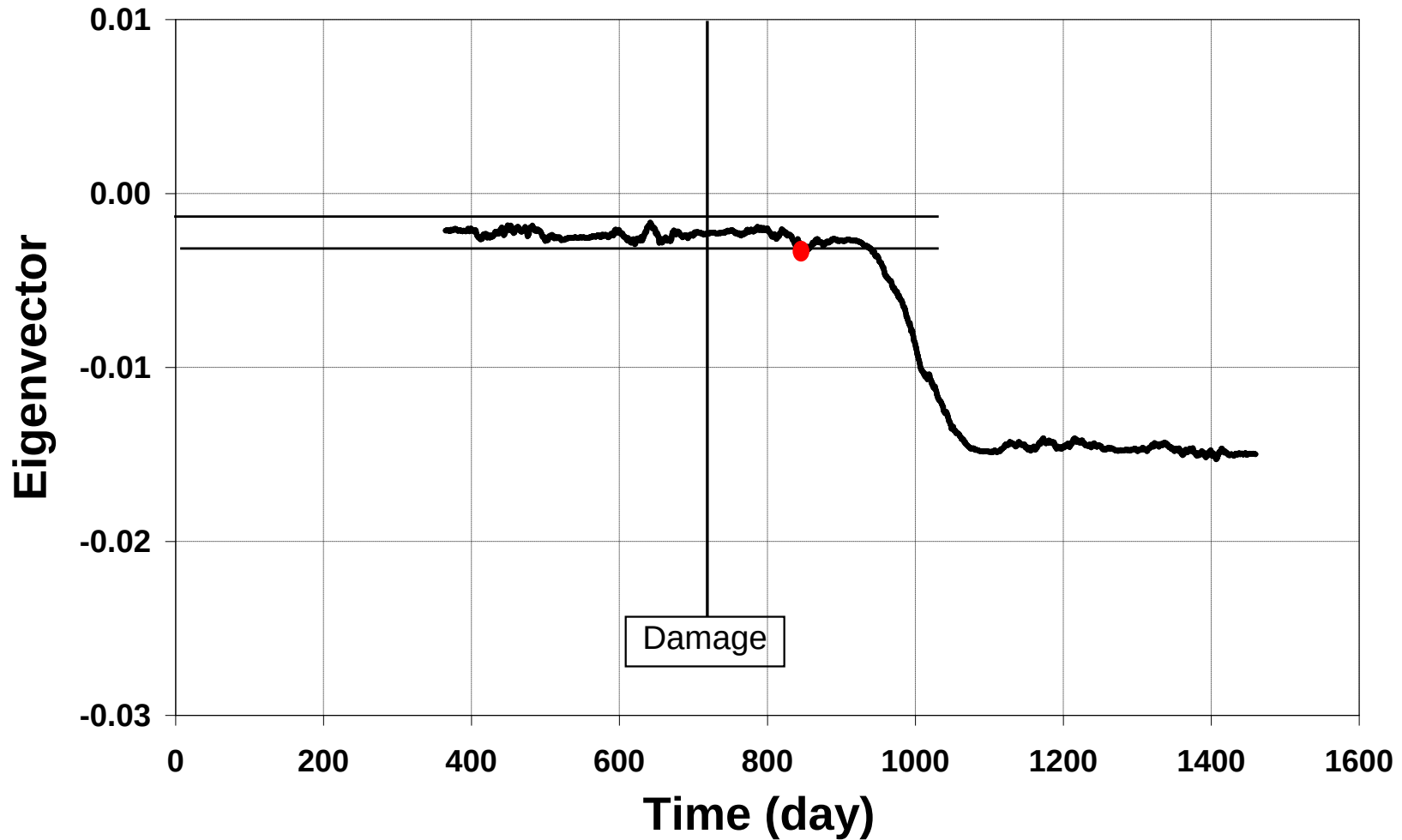
Bridge response correlated with diurnal temperature changes => **Evaluating the thermal response is fundamental to inferring structural performance from long-term measurements.**

Temperature & Bridges



Temperature-tilt correlation for the footbridge at NPL, Courtesy: NPL

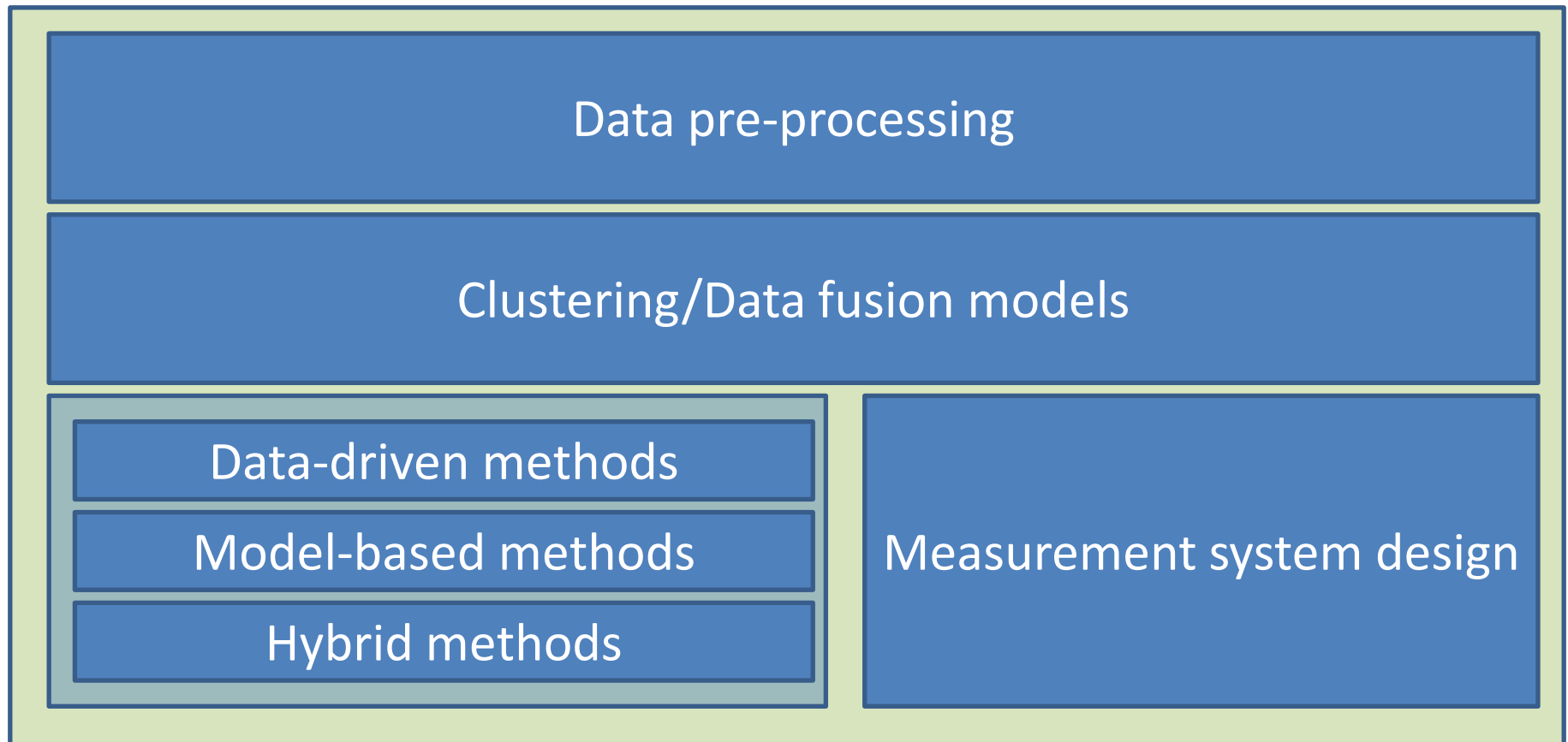
Anomaly detection



Summary

Monitoring Framework

Software interface for engineers



Thank you!