

## Vibrations and acoustics

### 8. Structural Health Monitoring

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#### What is structural health monitoring (SHM) ?

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It is a tool to assess the current and future state of health (condition) of a structure

#### Why do we need SHM ?

- Because of the aging of expensive and critical structures (airplanes ...)
- In order to reduce the costs (life and money) associated to current practice

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What is the current practice to assess the condition of structures ?

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- Scheduled maintenance
- Visual inspection techniques



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What is the current practice to assess the condition of structures ?

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Local inspection techniques



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Main problems associated to current practice

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- Risk of failure between two maintenances
- High costs
- Structure cannot be used while inspecting
- Difficulty to detect damage that is not visible



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What is the vision for SHM in the future ?

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- Large sensor networks
- Embedded intelligence
- Autonomous health monitoring

From [www.eads.net](http://www.eads.net)

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### What is vibration based SHM

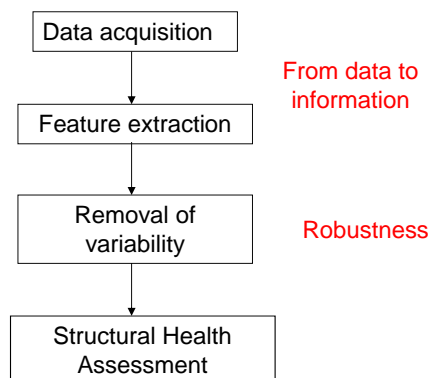


Damage  
=  
Change in the vibration characteristics

- Advantages :
- Could detect hidden damage
  - Permanent monitoring
  - Low-cost, global method

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### The different steps in SHM



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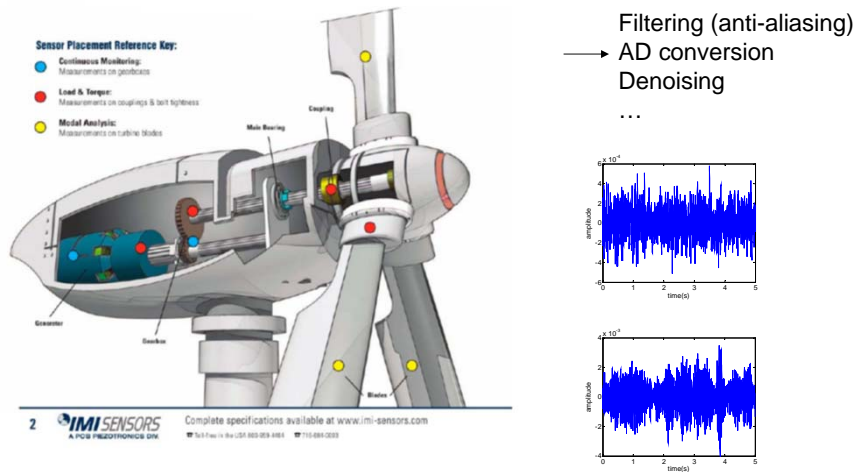
An example : off-shore wind turbine monitoring



Ambient vibrations : wind, waves  
Permanent monitoring, real-time data streaming

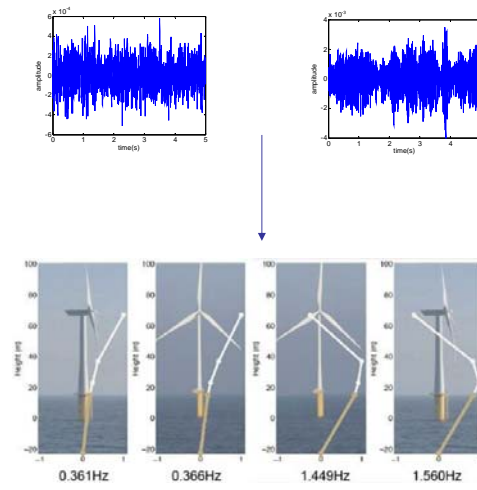
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Data acquisition



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Feature extraction: from data to information



<http://www.owi-lab.be>

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Main issue in SHM : variability



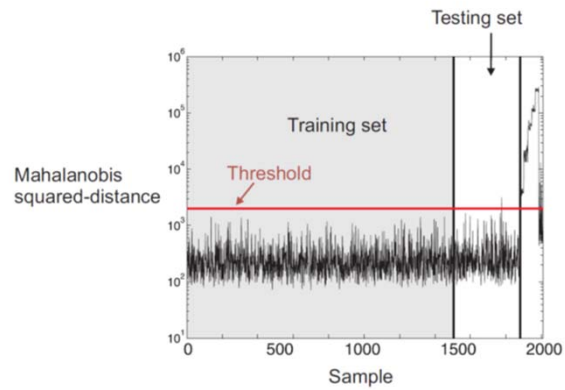
Effects of environmental and operational changes must be distinguished from effects of damage

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### Structural Health Assessment

- The four levels of SHM :
- damage detection
  - damage localization
  - damage quantification
  - residual lifetime estimation

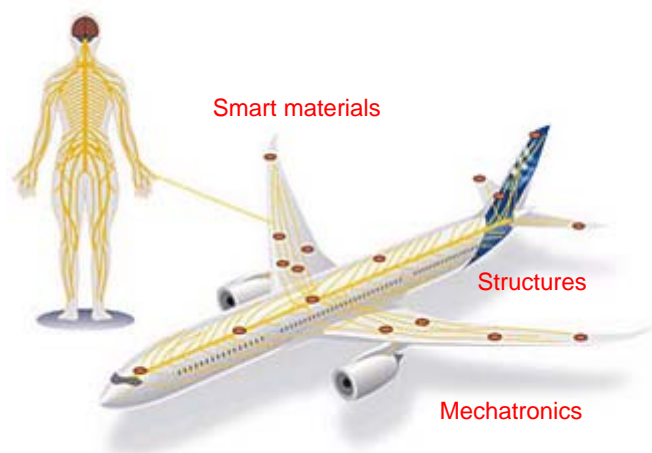
Example of level 1 control chart



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### Conclusion

A dream for the future ?



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