



Structure Monitoring for High Performance Transportation Systems

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Structure Inspections

Composite Materials

- Complex damage behavior
- Hard to detect delamination
- Time consuming



Cross-section of an impacted carbon plate with delamination



Ultrasonic scan of a wind turbine blade

Structure Monitoring

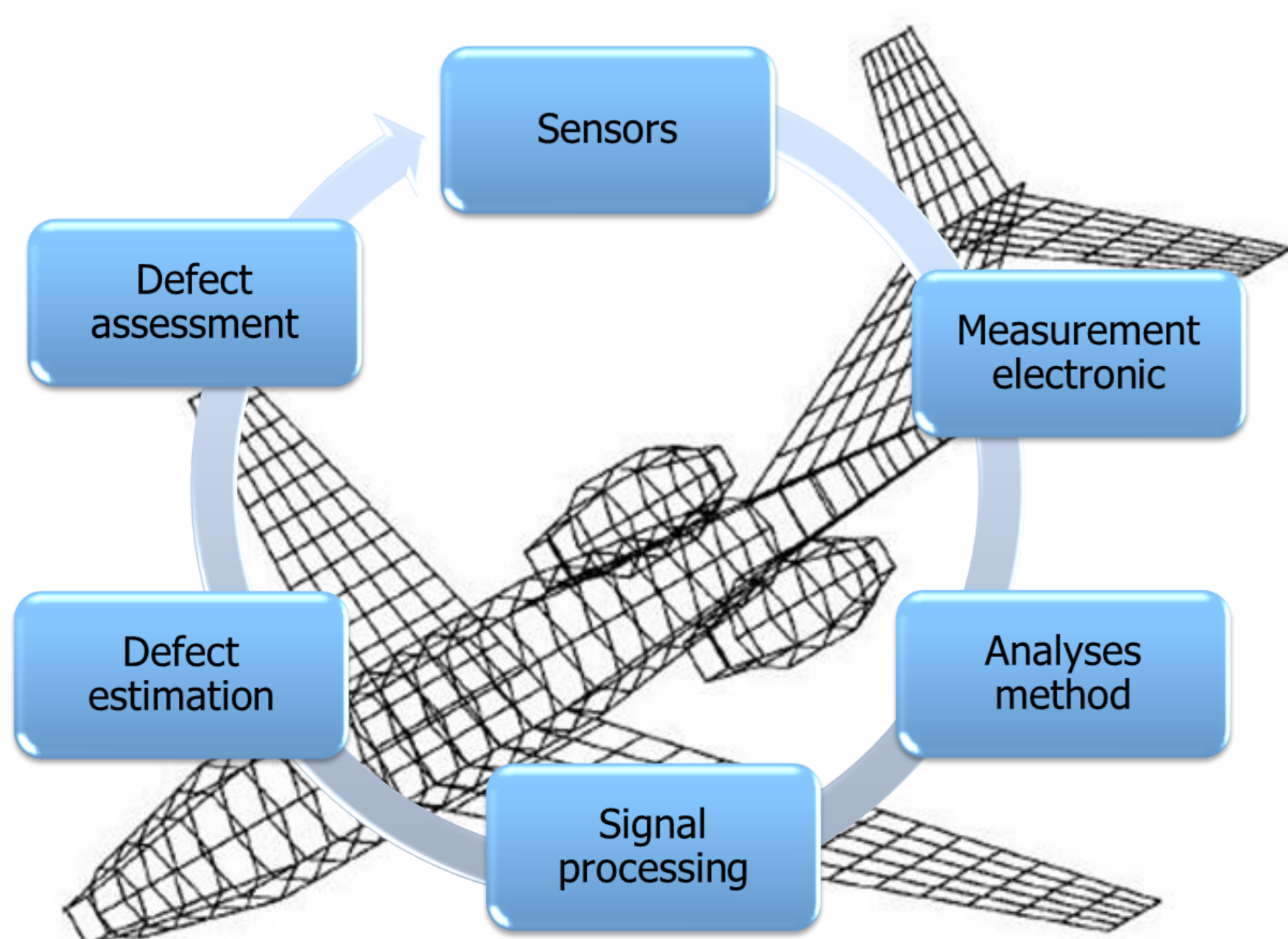
OFFERS:

- Real-time damage detection
- Autonomous operation
- On-demand inspection anywhere and anytime

BENEFITS:

- Reduce life cycle cost
- Perform efficient inspection
- Enable actions to avoid disasters

Structure Monitoring System



Principle components of a Structure Monitoring System

Developed Structure Monitoring System

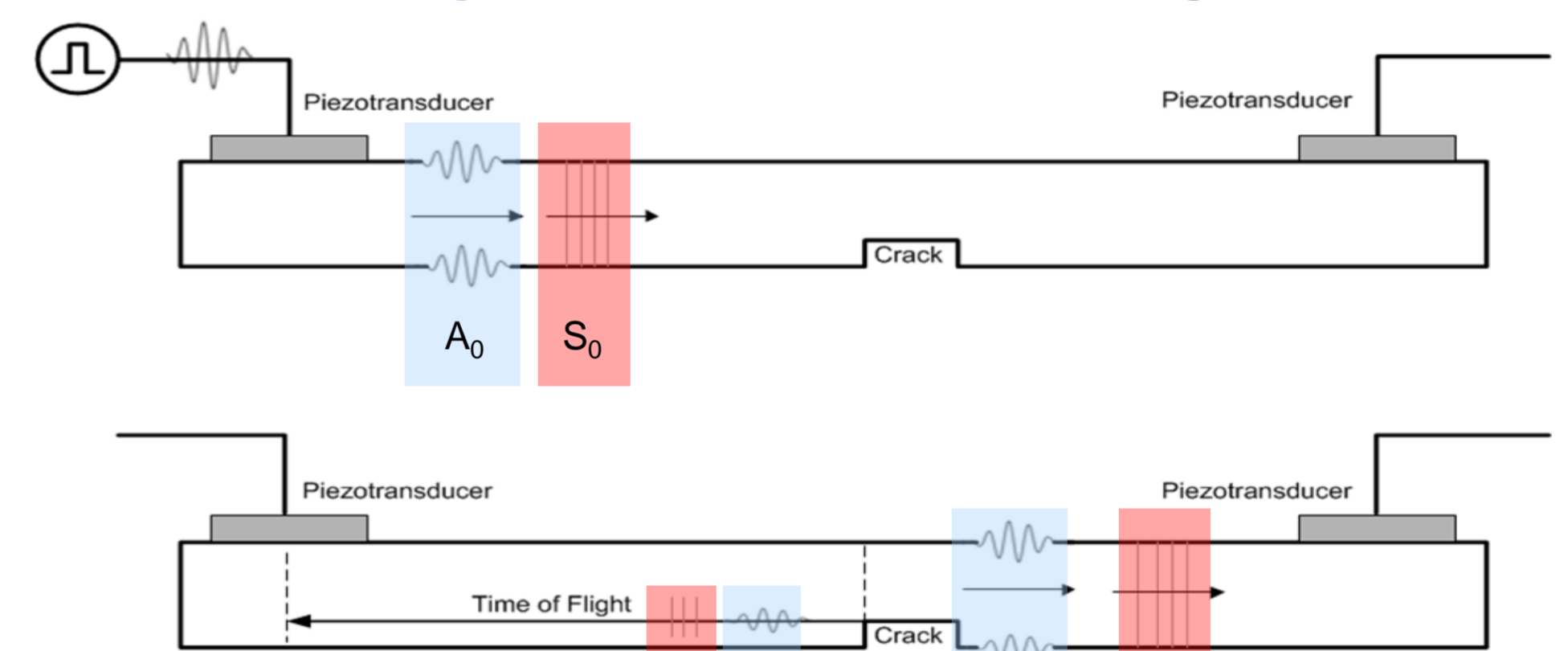
Sensors

- Piezoelectric transducers
- 1 Actuator, 5 Sensors



Analyses method

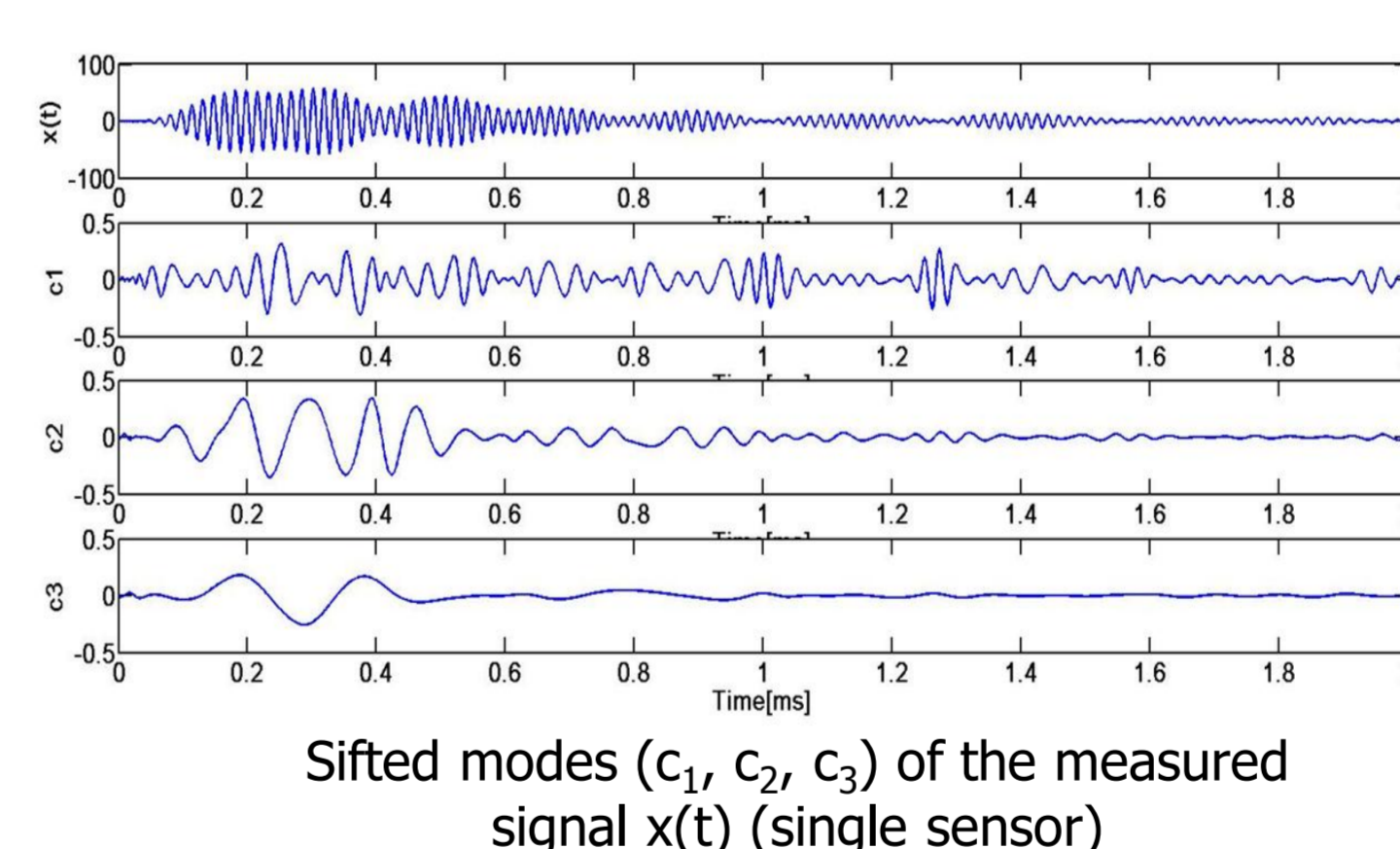
- Guided mechanical waves in structure
- Mode conversion because of dispersion
- Time-of-flight of reflected signal



Signal processing

Hilbert-Huang Transformation

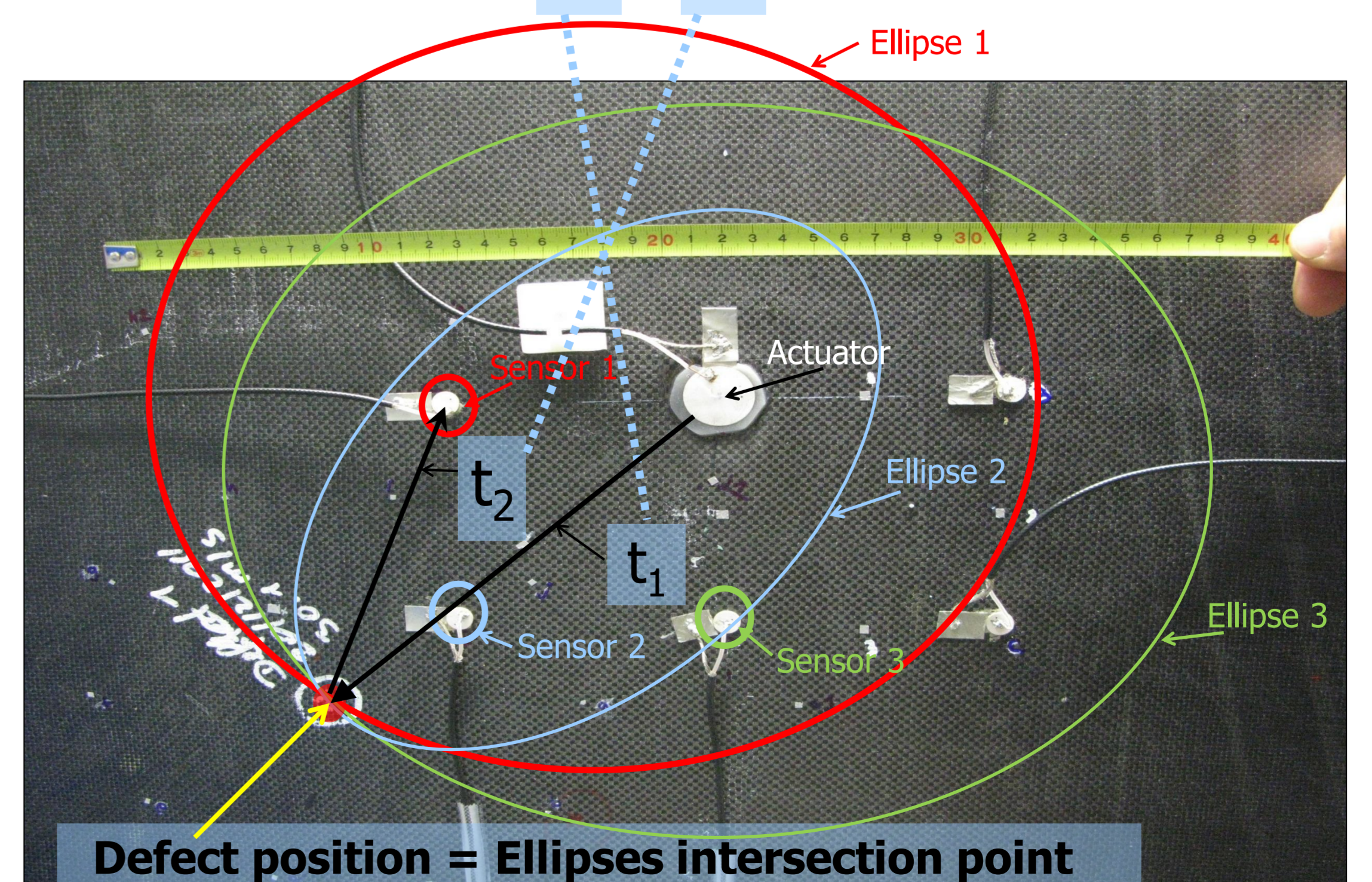
- Empirical mode decomposition
- Hilbert Transform



Defect estimation

Ellipse Method

- Time-of-flight = $t_1 + t_2$



Final experiment: carbon-composite plate with a single defect (Impact)