Feb. 26th-27th , 2018
UGA-Kobe Univ.
Bilateral Workshop on CPS and IoT

Sensors for health monitoring

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INSA-Lyon

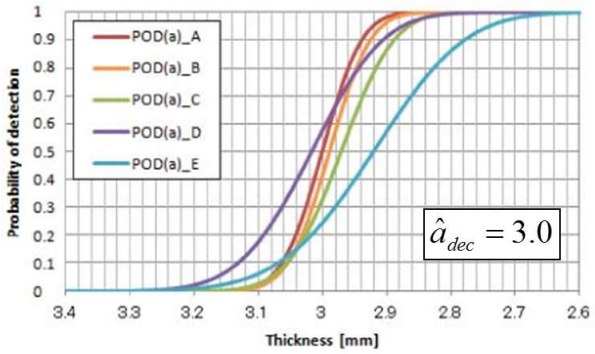
Sensing

- ✓ Sensing technologies are applied to hard materials and soft objects.
- ✓ Stochastic methods analyze and evaluate phenomena.

Guided Wave Technology

- Inspection of pipe wall thickness
- Inspection of corrosion
- Accident prediction

Stochastic Evaluation Method

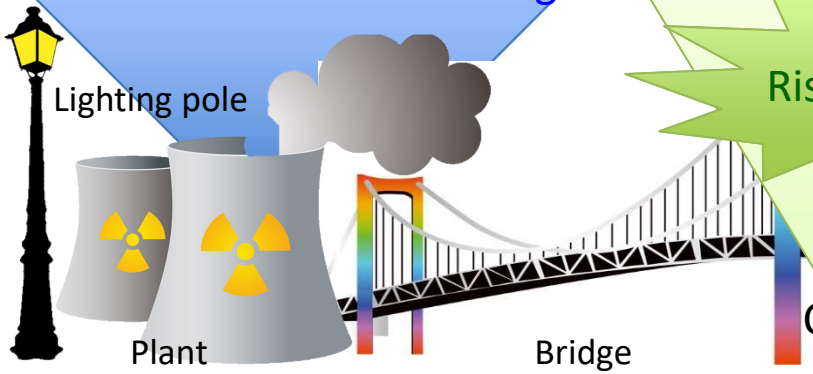


- Evaluation of inspection skills
- Evaluation of sensors
- Visualization of reliability

Stretchable Strain Sensor

- Flexible and stretchable
- Strain more than 200%
- Thinness and light weight

Structural Health Monitoring

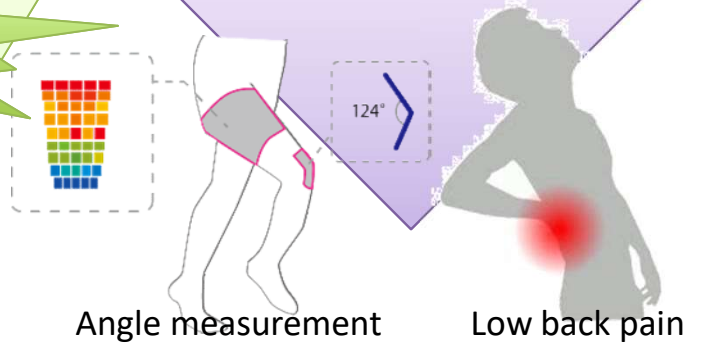


Smart city with safety and security

Risk assessment

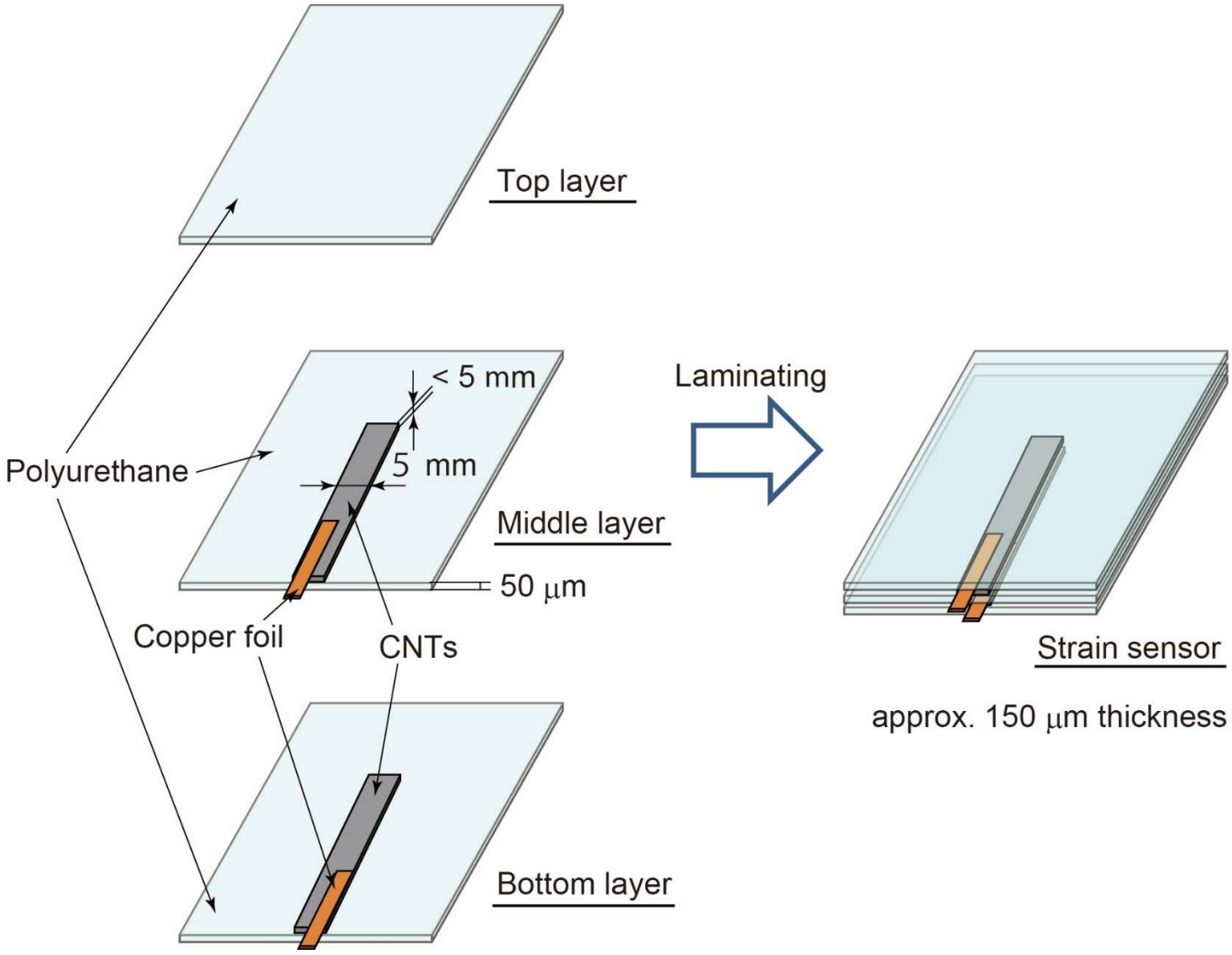
Contribution to

Motion and Health Monitoring



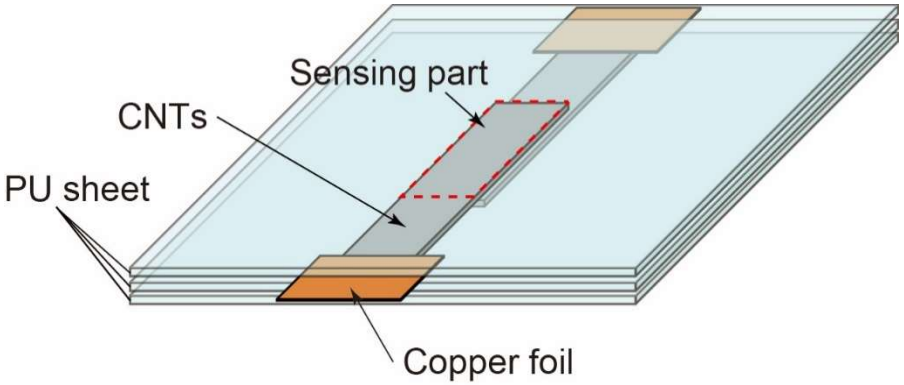
Smart medical care for healthy and long life

Structure

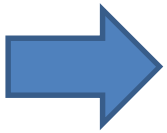

Top layer
< 5 mm
5 mm
Polyurethane
Middle layer
50 μm
Copper foil
CNTs
Bottom layer
Laminating
Strain sensor
approx. 150 μm thickness

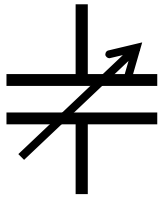
Principle

- The electrodes face each other, and make a sandwich.
- The sandwich structure works as a capacitor with parallel plate type.



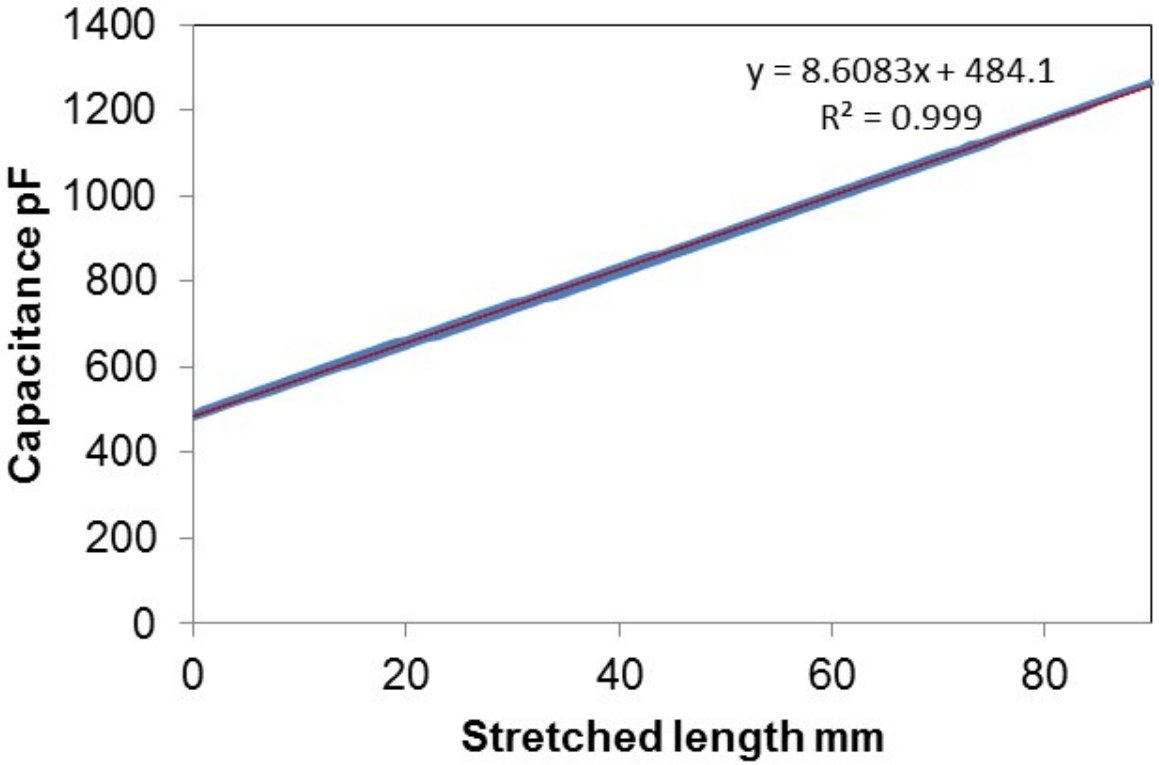
Sandwich structure





Variable capacitor

Strain vs Capacitance



$$C_n = nC_0$$

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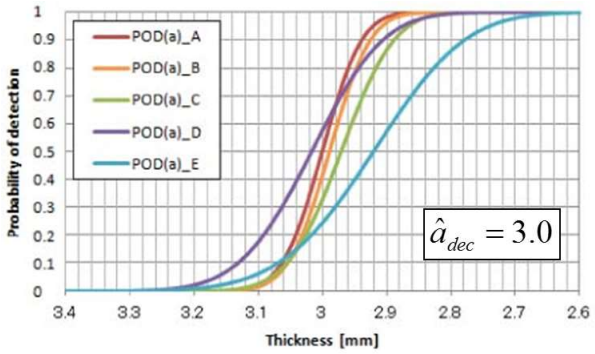

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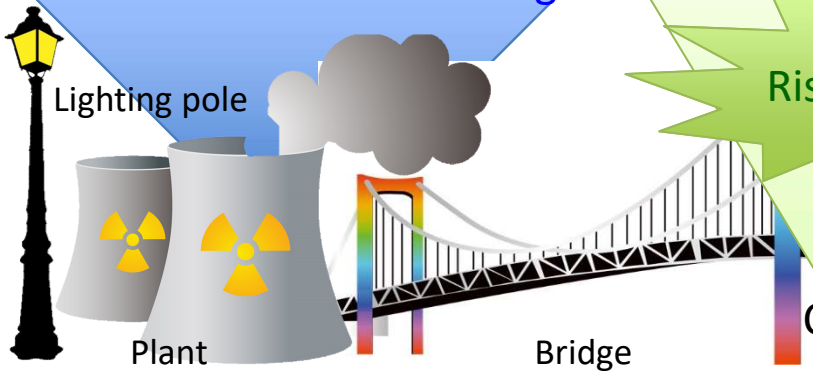

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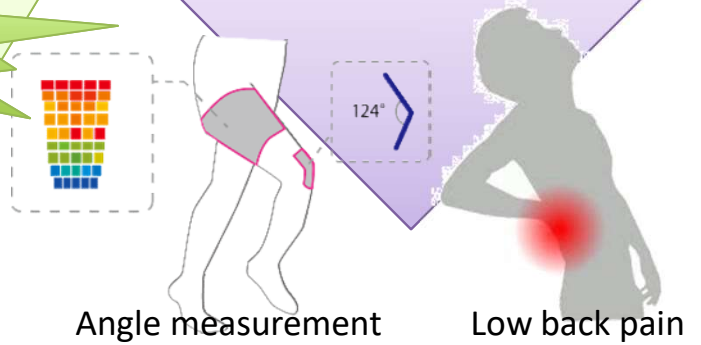
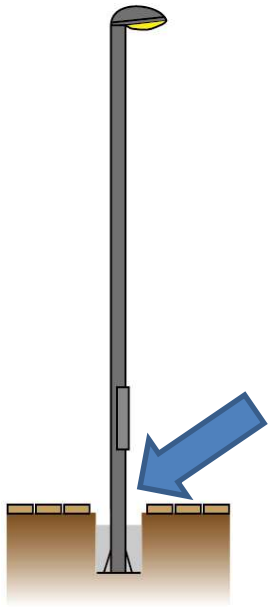


Smart medical care for healthy and long life

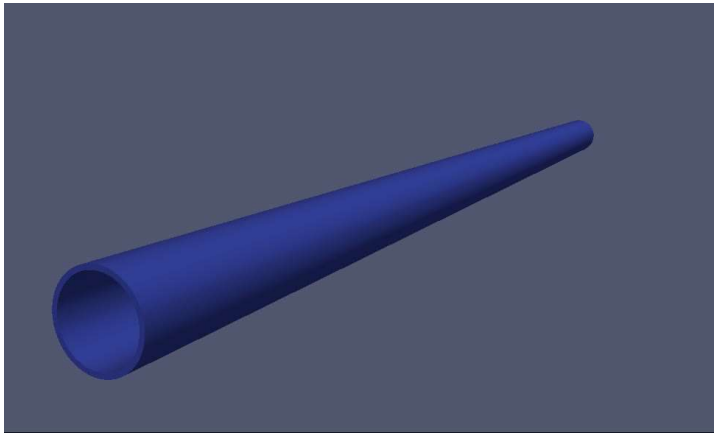
Objective

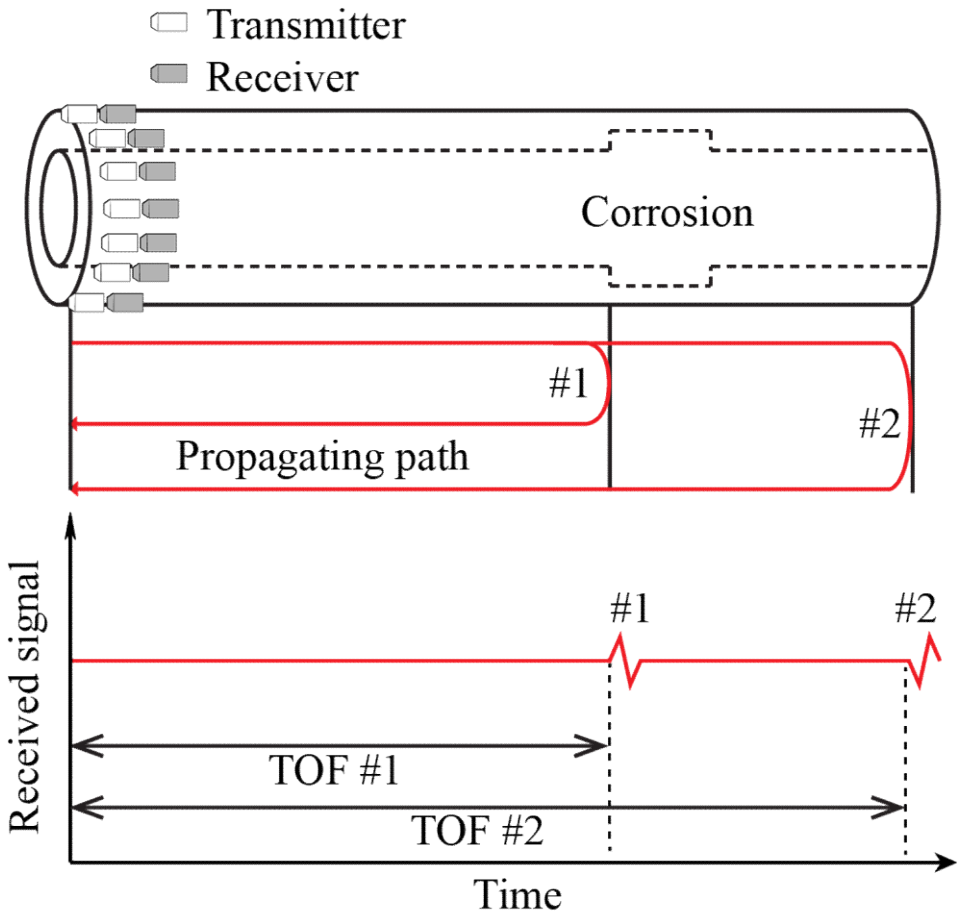
- In 2013, two accidents of falling down of an lighting pole happened in Kobe city.
- Inspection process requires much time and cost.
- Visual check → Self-health monitoring



Guided wave

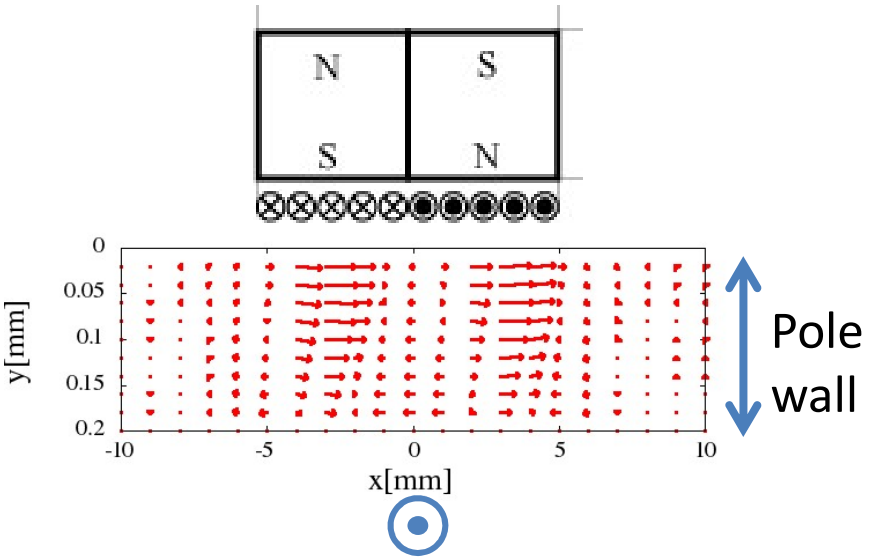
- Propagating in pipe structure in longitudinal direction.
- The position of the corrosion or terminal is estimated based on a time of flight.

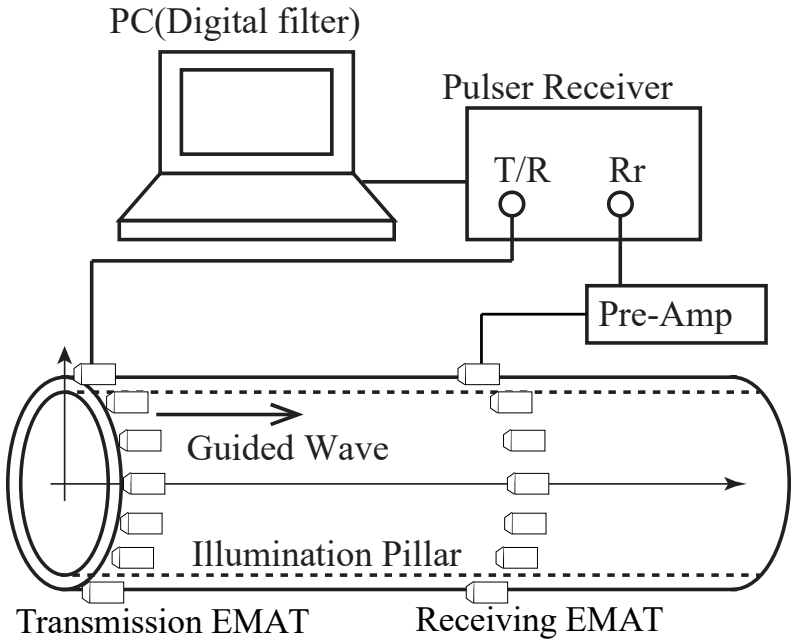




EMAT

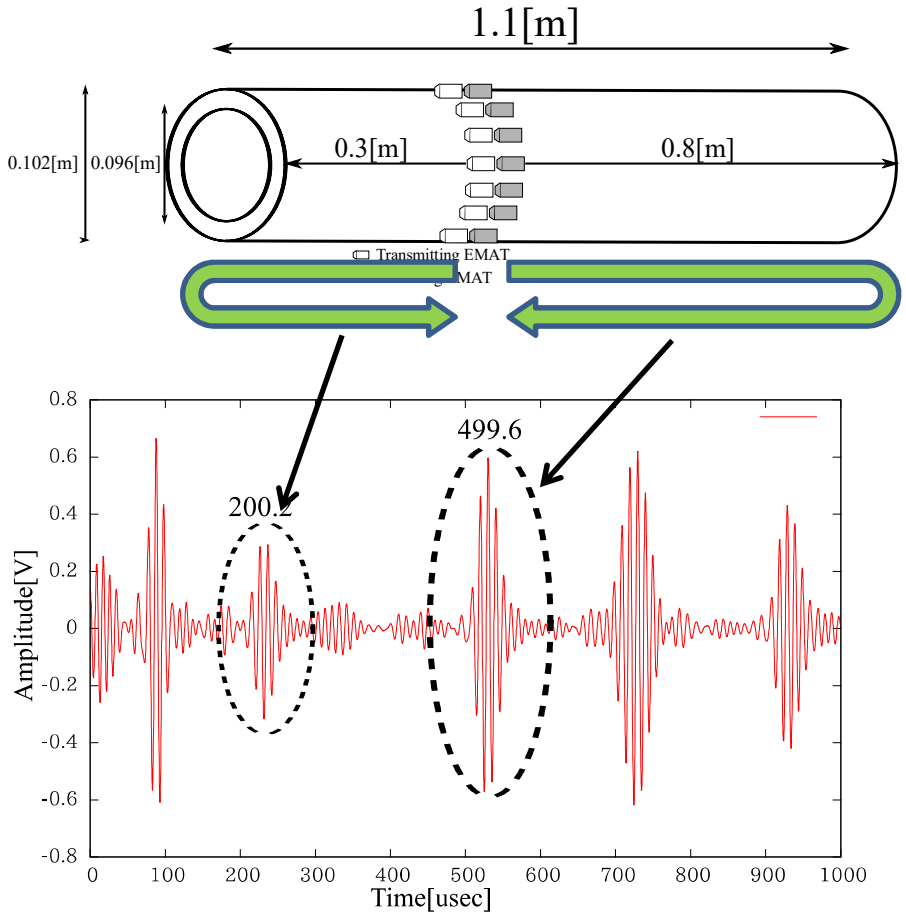
- Electromagnetic acoustic transducer (EMAT).
- The EMAT comprises two magnets and a coil.
- An alternating current to the coil generates an excitation force.



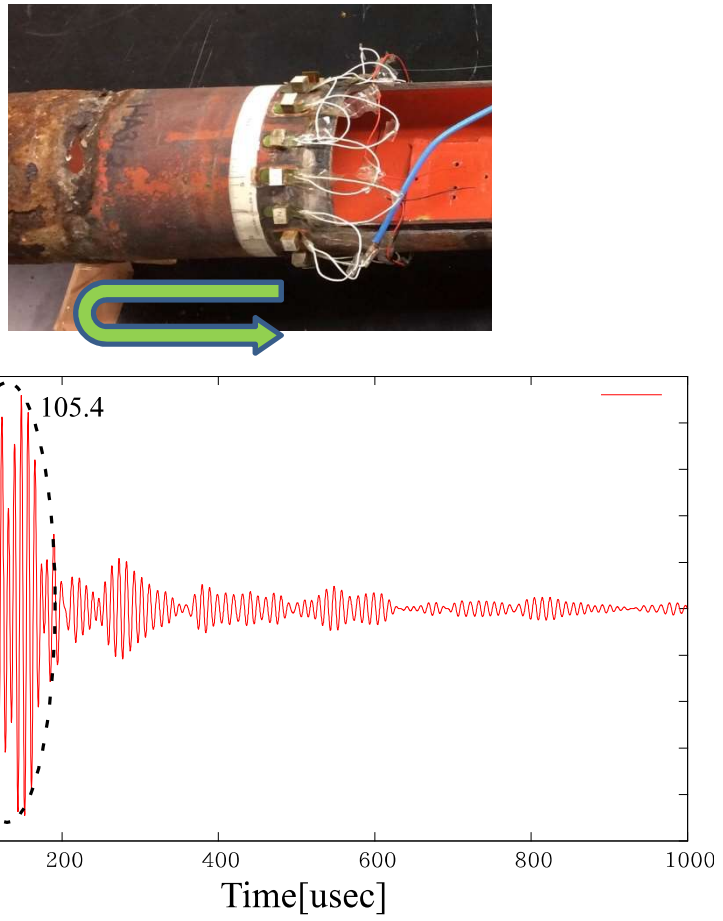


Inspection of retired lighting pole

Healthy part



Corrosion part



For self-health monitoring

- Experiments using lighting poles in operation.
- The guided wave is effective for the self-health monitoring of lighting poles.