■R&D Topics：Inspection, Monitoring and Diagnostics Technologies
■R&D Theme：Development of Laser Ultrasonic Visualization Technology for the Degradation Diagnosis of Steel Bridges
■Principal Investigator：Junji Takatsubo (Director, Tsukuba Technology Co., Ltd.)
■Collaborative Research Groups：AIST, Fukken Gijyutsu Consultants Co., Ltd.

R&D Objectives and Subjects

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Objectives

- Current crack inspection of steel bridges is carried out using MT(Magnetic Particle Test) , but has the following problems:
  ① It takes time to tear off the coating
  ② Recoating is necessary after inspection
  ③ Internal cracks cannot be detected
- In order to solve the above problems, we will develop a remote measurement system using laser ultrasonic technology, which can efficiently detect cracks under coating

Subjects

- Development of a high-speed laser-scanning system to measure the video image of ultrasounds propagating in a bridge
- Construction of a laser optic system which enables remote measurement
- Manufacture of a small and light-weight laser ultrasonic visualization system
- Development of an image analysis method to detect the location and size of cracks

Current Accomplishments (1/2)

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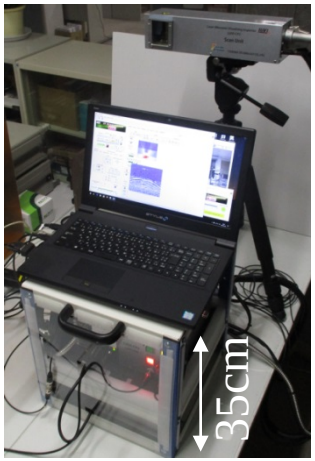
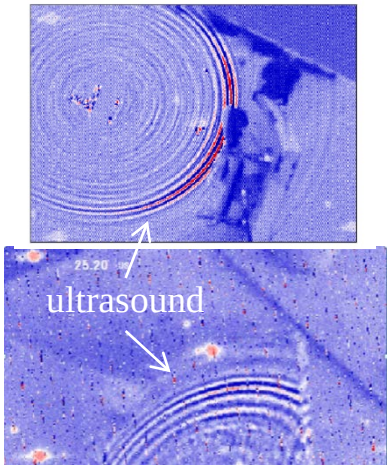
Prototype system can be carried in a small crane bucket with two persons

The only instrument in the world that can inspect a steel bridge on-site by a video image of the propagation of ultrasonic waves.

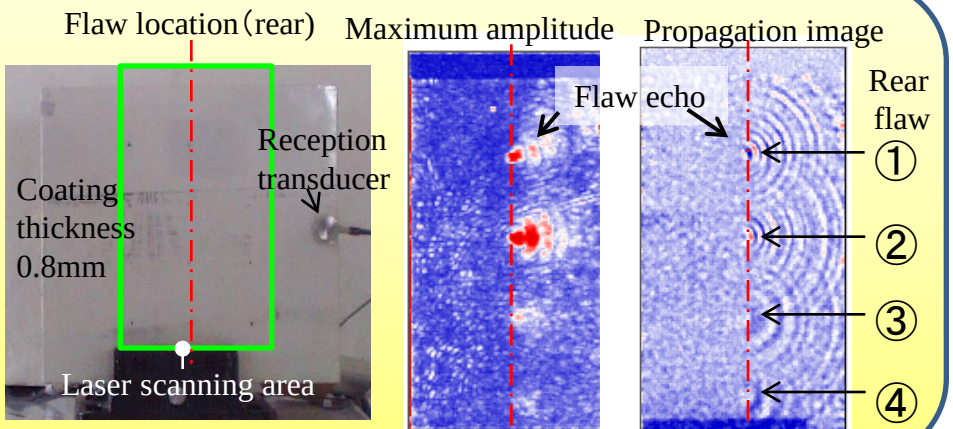


Portable system for field operations



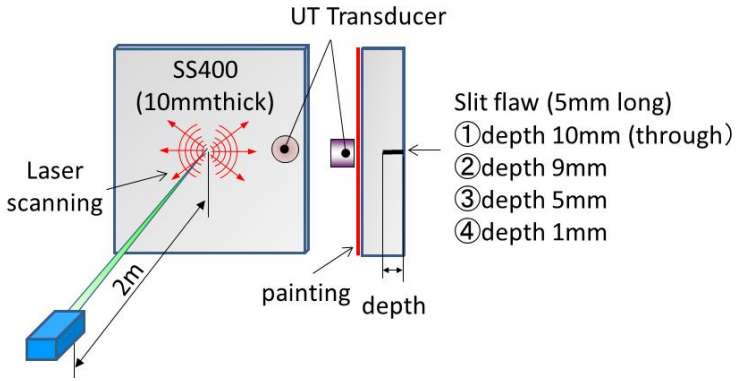
Measured images of ultrasonic propagation on a steel bridge

Slit flaws under coating can be detected from 2 m away



Inspection of coating

Inspection of internal cracks that are under coating



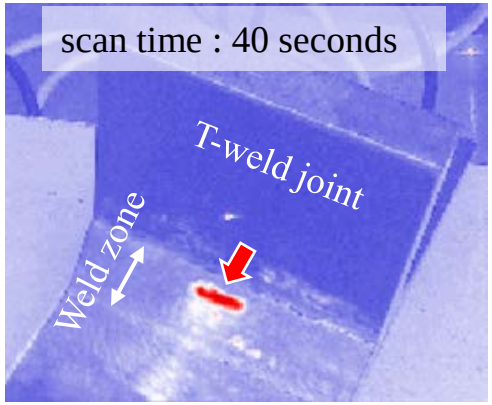
Current Accomplishments (2/2)

High-speed visualization

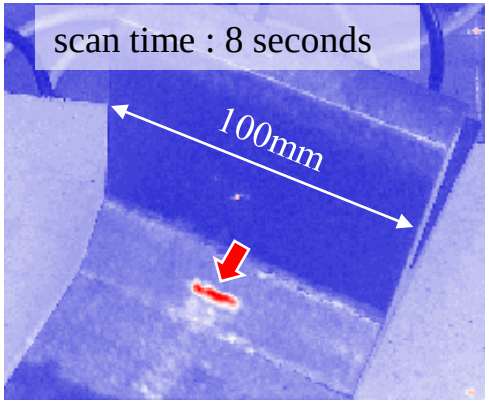
Laser scan speed: more than 5000 points/sec

visualized in 2 sec

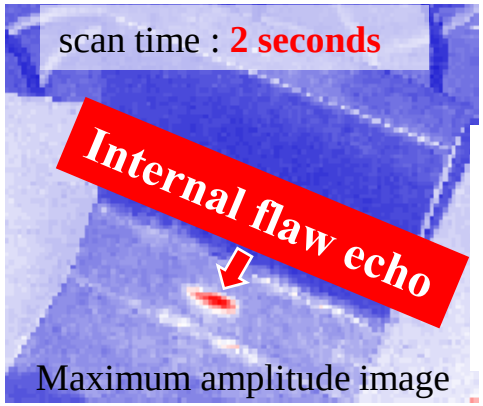
Scan speed: 500Hz, Scan spacing: 0.8mm



5,000Hz, 0.8mm



5,000Hz, 1.5mm



Quick Inspection

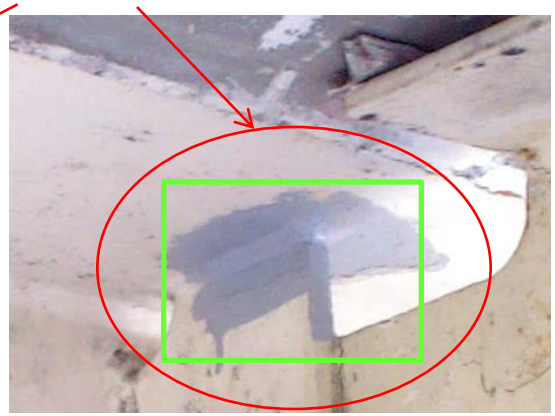
Inspection area of 500 mm x 500 mm can be visualized in 22 sec (scan speed: 5000 Hz, scan spacing: 1.5 mm)

Efficient for steel bridge inspections

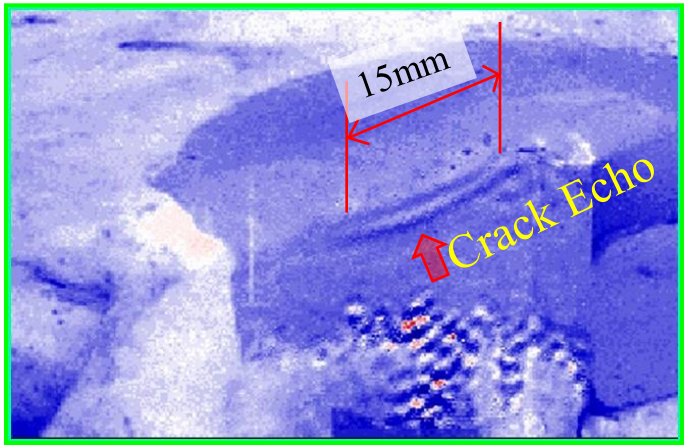
- **Fatigue cracks that were coated could be detected**
- **Detected crack lengths agreed well with the MT results**

Inspection part

Steel bridge on National Road No.50



Inspection area (inside the green frame)



Visualized crack echo

Goals

Fifty-percent reduction in inspection duration and cost

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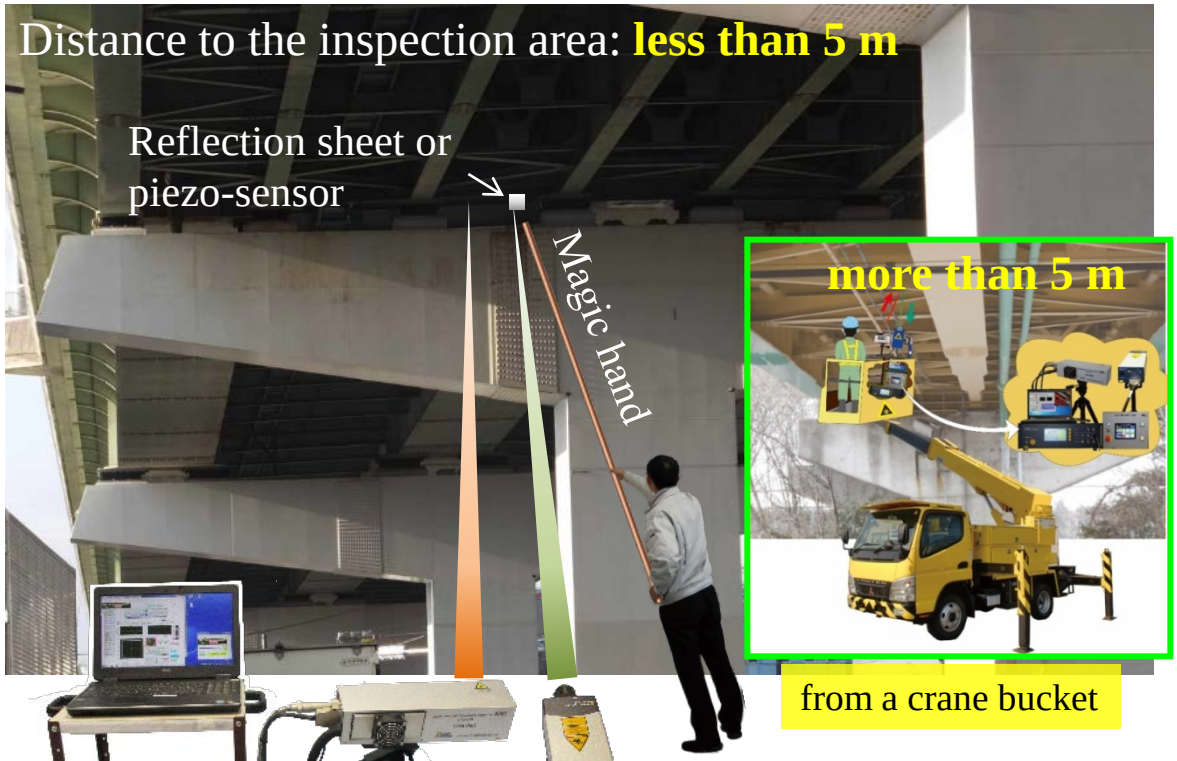

International Plan

NON-CONTACT INSPECTION

Using reflection sheets

Remote Inspection System

Inspection object: Stiffening plate, Welding member

CONTACT INSPECTION

Using contact sensors

Portable Quick Inspection System

Inspection object: Steel floor

- Cracks of 5 mm in length under coating can be detected from a position 5 m away (by non-contact inspection).
- Cracks of 1 mm in length under coating can be detected (by contact inspection)

Road bridges, Highways, Railways, Industrial facilities