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[Smart materials and structures]

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Smart Material Systems

Department of System Innovation

Smart Materials and Structures

Damage detection in composite materials and deployable structures

When small devices for damage detection or new deployment mechanisms are integrated into traditional structural members, they become smart structures. Especially, we are developing optical-fiber ultrasonic sensors for structural health monitoring to detect damages in aircraft composite materials. Moreover, new deployable structures for spacecraft are proposed based on geometry of Origami.

- Ultrasonic propagation system integrated into composites: Succeeded in quantitative detection of inner damages based on mode conversions of broadband guided waves
- Development of ultrasensitive optical-fiber ultrasonic sensor: Detection of AE signals in composites at the same level as piezo-ceramic sensors
- Monitoring system with active and passive functions: From ultrasonic waves to Impacts
- New deployable structures based on an elastic origami model

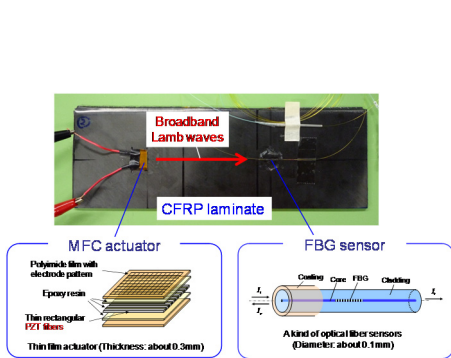


Fig. 1 Ultrasonic propagation system Integrated into composite laminate

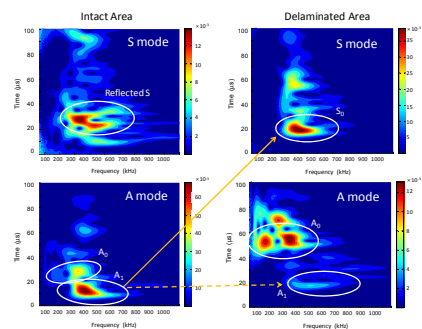


Fig. 2 Mode conversion behavior of broadband Lamb waves for quantitative damage detection

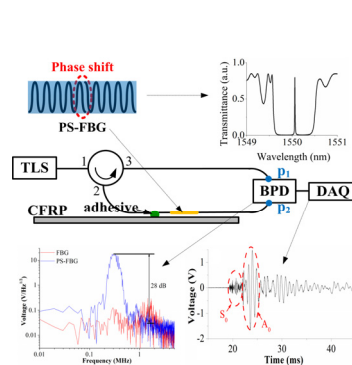


Fig. 3 Ultrasensitive optical-fiber ultrasonic sensor based on phase-shifted FBG

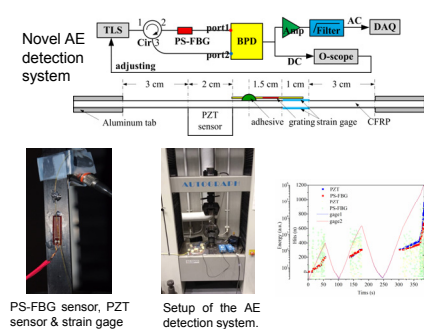


Fig. 4 AE measurement for composites by using the system shown in Fig. 3

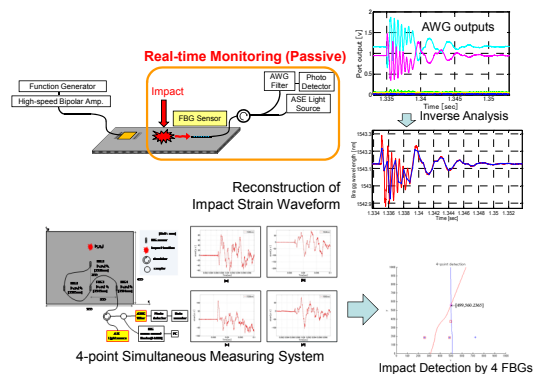


Fig. 5 Detection of impact behavior with active and passive monitoring system

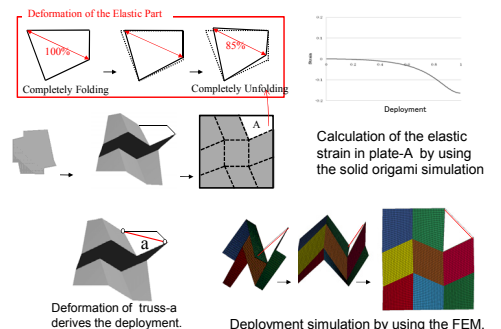


Fig. 6 New deployable structure based on an elastic origami model