CMI

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[Dynamic health monitoring and novel deployable structure]

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Smart Material Systems

Department of System Innovation

Smart Materials and Structures

Damage detection in composite materials and novel 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 high-sensitive optical-fiber ultrasonic sensors built in aircraft structures and structural health monitoring or NDE methods using ultrasonic guided waves. Moreover, novel deployable structures are proposed based on geometry of Origami or wings of insects.

- High-sensitive optical-fiber ultrasonic sensors: Detection of AE signals at the same level as piezo-ceramic sensors
- Ultrasonic propagation system integrated into composites: Succeeded in quantitative detection of inner damages based on mode conversions of broadband guided waves
- Design method of novel self-deployable structure based on misaligned rigid origami models
- Smart adaptive structures by mimicking wing folding/unfolding mechanisms of insects

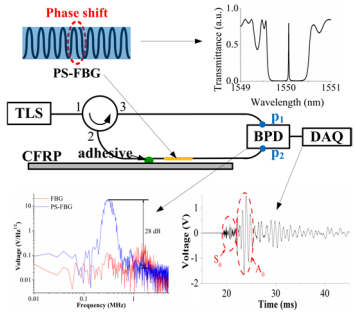

Fig. 1 High-sensitive optical-fiber ultrasonic Sensor based on pnase-shifted FBG

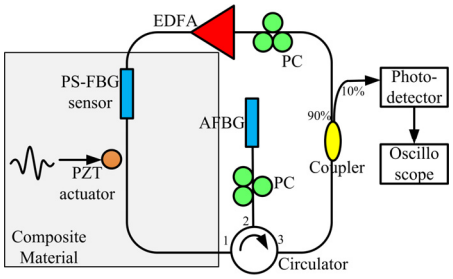

Fig. 2 Fiber-ring-laser sensor using built-in PS-FBG with ultrasensitive, ultra-broadband, and self-adjustment function for disturbance

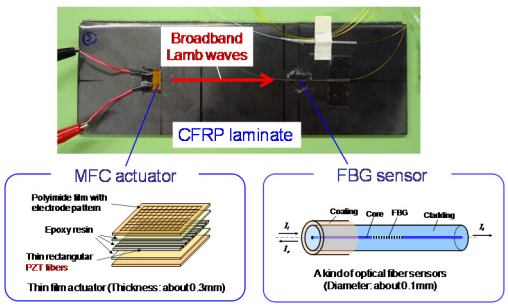

Fig. 3 Ultrasonic propagation system integrated into composite laminates

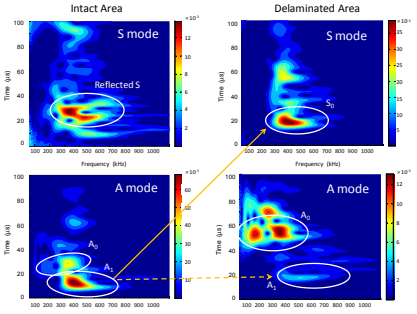

Fig. 4 Mode conversion behavior of broadband Lamb waves for quantitative damage detection

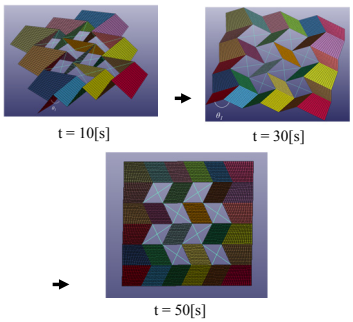

Fig. 5 Self-deploying origami models using geometrically misaligned crease patterns

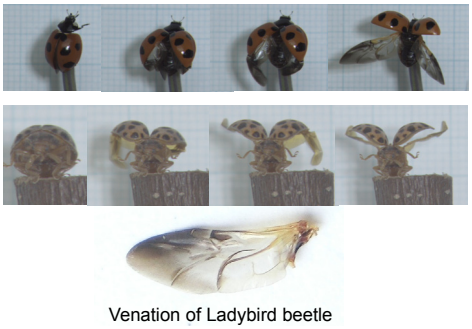

Fig. 6 Take off motions of Ladybird beetles imaged with a high-speed camera