



FIBER OPTIC SENSING





SOLUTIONS

Our distributed sensing solutions offer high-resolution strain and temperature measurements using low-cost optical fiber as the sensor; providing unprecedented sensor density for your strain or temperature sensing application. Our systems can provide hundreds of measurement locations per meter of fiber with resolution of a few microstrain.

Distributed sensing allows customers to fully characterize their materials; offering the ability to test a structure at specific points of interest or continuously along the fiber with user-configurable sensing locations and gage lengths. In contrast to traditional discrete sensing solutions, fully distributed sensing provides a global view of the material.

Our sensing platforms provide insight into the performance, tolerances, and failure mechanisms of structures; enabling greatly reduced time, complexity, and expense of instrumentation and measurement for test applications.

APPLICATIONS

With sensors suitable for surface bonding or embedding in composites, this technology can accomplish your objectives either by direct integration during manufacturing or later installation.

- Non-destructive testing
- In-situ strain and temperature monitoring
- Design verification
- Structural load & fatigue testing
- Embedded sensing
- Composite cure monitoring
- Structural health monitoring



MARKETS

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AEROSPACE

- Enables structural load and fatigue testing
- Finds defects and product failures
- Supplies better information while reducing SWAP (size, weight, and power)
- Offers greater insight into residual strain left by impacts on composite structures
- Detects defects during the manufacturing process

ENERGY

- Enables efficient designs for renewable energy generation
- Provides early detection of cracks, disjoints and dislocations on a wind turbine blade
- Allows for inexpensive, detailed, real-time temperature monitoring of power generators
- Monitors strain profiles of hydrogen fuel cells

COMPOSITES

- Allows one to know what is happening inside a composite structure; to see the damage even when it's not visible
- Provides a constant picture of load distribution in a structure
- Detects defects during manufacture and fatigue cycling of composite structures

AUTOMOTIVE

- Provides more detail from the autoclave to the racetrack
- Can be used to optimize design and improve performance
- Monitors health of composite structures
- Profiles temperature in catalytic converters and batteries for electric vehicles

INDUSTRIAL

- Monitors temperature in chemical manufacturing
- Enables structural health monitoring

TECHNOLOGY COMPARISONS

STRAIN GAGE

- One sensing point per channel
- Limited sensing points
- Labor-intensive installation

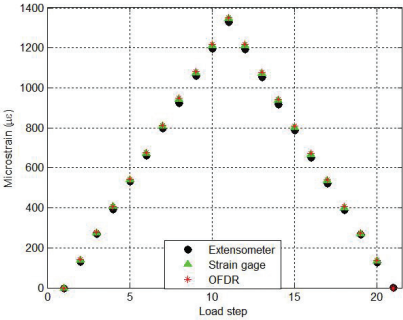
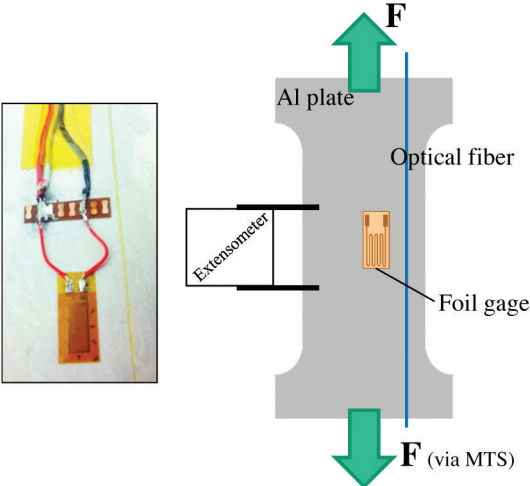
VS.

ODISI PLATFORM

- Thousands of sensing points per fiber
- Full distributed sensing with sub-cm spatial resolution
- Fast and efficient installation

ACCURACY RELATIVE TO COMMON STRAIN MEASUREMENT TECHNIQUES

Luna's Rayleigh Scatter distributed sensing technique provides the ability to make numerous strain measurements at mm-length spatial resolution. Comparative measurements between fiber, strain gage, and extensometer were carried out on aluminum coupons clamped in an MTS tensile testing machine.



Sensor	Deviation from Extensometer Reading
Fiber	1.14%
Foil Gage	1.26%

Sensor	Deviation from Foil Gage Reading
Fiber	0.12 %



PRODUCTS

ODiSI A

Delivers fully distributed strain and temperature measurements with sub-cm spatial resolution, using optical fiber as the sensor

- Measurement ranges of $\pm 13,000 \mu\text{Strain}$, -50 to $300\text{ }^\circ\text{C}$
- Repeatability of $\pm 2 \mu\text{Strain}$, $\pm 0.2\text{ }^\circ\text{C}$
- Sub cm spatial resolution
- Maximum sensing lengths of 50 meters

ODiSI B

Delivers high speed, fully distributed strain and temperature measurements with 5mm spatial resolution, using optical fiber as the sensor

- 100 Hz acquisition over entire fiber
- 25 Hz active display over 1 meter
- Acquisition over 10 meter sensing range
- Measurement ranges of $\pm 10,000 \mu\text{Strain}$, -50 to $300\text{ }^\circ\text{C}$
- Repeatability of $\pm 5 \mu\text{Strain}$, $\pm 0.4\text{ }^\circ\text{C}$
- 5 mm spatial resolution

OBR 4600

A high-resolution reflectometer designed for component and short-run network testing and troubleshooting, with an option for integrated temperature and strain sensing

- Measure 30 m with $10\text{ }\mu\text{m}$ resolution in less than 7 seconds
- Continuously measure a 1 m segment at up to 3 Hz
- Test and troubleshoot short-run networks ($<2\text{ km}$)
- -130 dB sensitivity
- 70 dB dynamic range
- 2 kilometer length range with no dead zone
- Micrometer resolution up to 70 meters
- $<0.05\text{ dB}$ insertion loss resolution

DSS 4300

Measures distributed temperature and strain using Fiber Bragg Gratings as the sensor

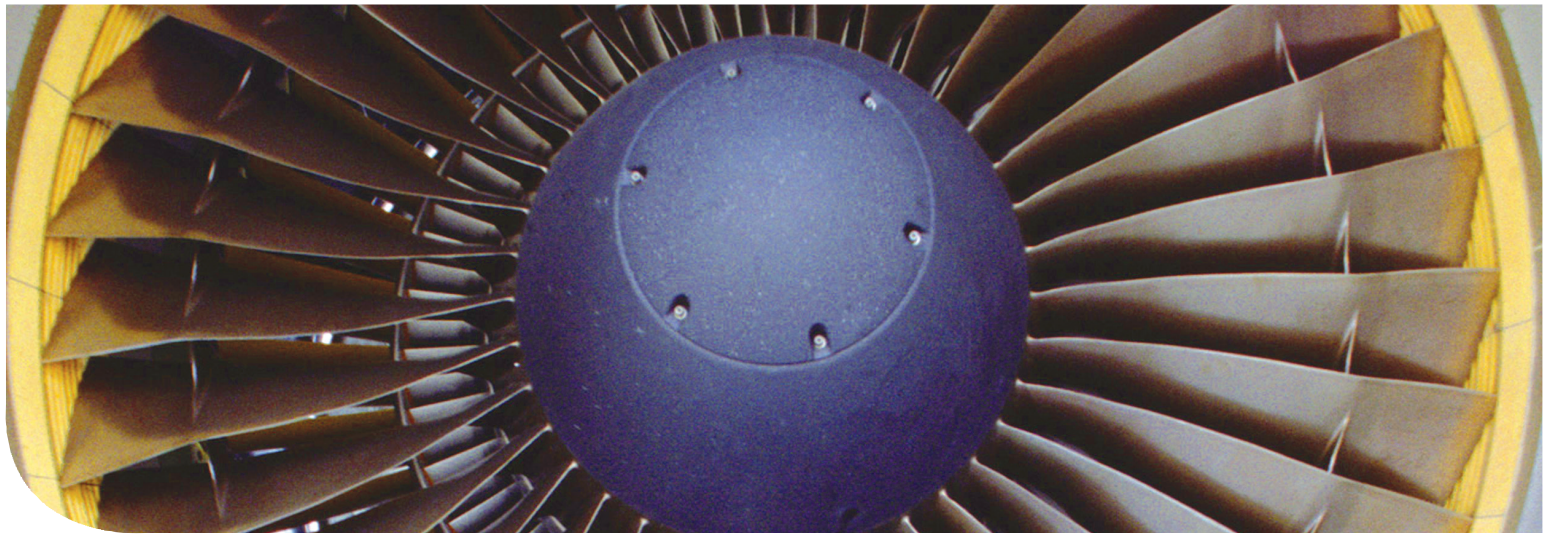
- $\pm 1 \mu\text{Strain}$ resolution
- $\pm 0.1\text{ }^\circ\text{C}$ resolution
- 1 cm spatial resolution up to 70 meters

FIBER OPTIC SENSING

Directly compares the capabilities and intended uses of the various instruments that comprise Luna's fiber optic sensing platform.

● Included ● Optional ⊕ Not Available

Feature	OBR 4600 with Temperature & Strain Option	ODiSI A	ODiSI B
Fiber Type	Any	Luna Rayleigh	Luna Rayleigh
Reflectometer Capability	●	⊕	⊕
# Channels	1	1	1
Mux compatible	●	●	⊕
Minimum Gage Length	1 mm	1 mm	5 mm
Adjustable Gage Length	●	●	⊕
ODiSI Sensing GUI	⊕	●	●
Distributed Sensing	●	●	●
Point Sensors	Manually	●	⊕
FBG Sensors	Manually	⊕	⊕
Maximum Sensing Range	70 m (2 km optional)	10 m / 50 m	10 m
Stand-off Distance	0	10 m	50 m
Maximum Acquisition Rate	0.3 Hz	5 Hz / 2.5 Hz	100 Hz
Data Logging	●	●	●
Scheduled Logging	●	●	●



ABOUT LUNA

Since 1990, we have a proven track record of leveraging our world class R&D division to identify, develop, and commercialize disruptive technologies. We are innovators, engineers, researchers and developers of technology; driving breakthroughs in fields as diverse as healthcare, telecommunications, energy, and defense.

Our leadership in distributed fiber sensing is evident through the proprietary advanced sensing systems we've brought to market that improve manufacturing and testing of structures and materials.

Our innovation begins with excellence in research and develops into technologies that can be effectively commercialized. With more than 100 patents, our technologists push innovation to the edge of imagination and are recognized as leaders in transforming science into solutions.

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