DirectShear™-Optical Sensors

High-Temperature Shear Stress Instrumentation

Complete sensor systems for non-intrusive, direct, simultaneous mean and fluctuating wall shear stress measurement

Optical gratings on a micromachined floating element enable direct measurement of shear stress in harsh environments

Sensing System Overview

- Optical micromachined floating element sensor for time-resolved, one-dimensional, direct shear stress measurements in harsh environments
- Optical gratings for direct transduction of shear stress with remote optical fiber readout
- Silicon/Pyrex sensor structure for high-temperature environments (up to 400°C continuous) or sapphire for ultra-high temperatures (up to 1000°C)
- Optimized Sensor Control Unit (SCU) for high dynamic range and bandwidth
- Suite of sensor models for different applications

Applications

- Instrumentation-grade skin friction sensing in high temperatures and harsh environments
- Aerodynamic drag research
- Detection of flow separation
- High-speed wind tunnel testing

Benefits

- Direct measurement of shear stress
- Harsh environment capable
- Non-intrusive - minimal flow disturbance
- High resolution, dynamic range and bandwidth
- Immune to EMI

DirectShear™-Optical Sensors

Micromachined floating element sensor heads comprised of Silicon/ Pyrex (left) and Sapphire (right).

The SCU provides a fiber-coupled optical source and detectors and electronics to produce an analog voltage for output to a DAQ

Sensor Heads

- Optical transduction for harsh environments - no electronics in the sensor head
- Non-intrusive — backside optical fiber readout for minimal flow disturbance
- Sensors are packaged in a cylindrical stainless steel housing
- Custom housings/materials available
- Integrated ruggedized duplex LC optical fiber cable
- Silicon/Pyrex construction for up to 400°C operation (or Sapphire for up to 1000°C)

Sensor Control Unit (SCU)

- Mean and fluctuating optical sensor measurements
- Selectable low-noise AC or rechargeable Li-ion battery power source
- LED status indicators
- Rugged, industrial duplex LC fiber connection

Sensor Model	Shear Stress [Pa]	Bandwidth [kHz]	Element Size [mm] x [mm]	Sensitivity [mV/Pa]	Resolution [mPa]
OS-D10	10	0.8	1.5 x 0.7	190	0.1
OS-D50	50	1.8	1 x 0.7	40	0.5
OS-D100	100	2.5	1 x 1	20	1
OS-A05	300	5	0.4 x 0.4	5	2
OS-A10	1000	10	0.3 x 0.3	1.3	10
OS-A20	5000	20	0.3 x 0.3	0.3	50

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With a deep knowledge of aerospace test and over two decades researching best-in-class sensor development techniques, IC² delivers scientific-grade precision sensors that push the envelope of aerospace measurement accuracy and performance.

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