



DirectShear™ Sensors

Shear Stress Instrumentation



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

Sensing System Overview

- Micromachined floating element sensor that enables time-resolved, one-dimensional, direct shear stress measurements
- Compact, robust sensor package for flush mounting
- Optimized Capacitive Sensor Unit (CSU) for high dynamic range and bandwidth
- Suite of sensor performance ranges and form factors for different applications
- Originally developed for NASA



Micromachined sensor heads in stainless steel housings for flush-mounted installation

Applications

- Instrumentation-grade skin friction sensing
- Aerodynamic drag research
- Detection of flow separation
- Wind tunnel instrumentation

Benefits

- Direct measurement – no heat transfer calibration
- Non-intrusive – minimal flow disturbance
- High resolution, dynamic range and bandwidth
- Highly accurate, quantitative measurements

DirectShear™ Sensors



Multiple sensor head form factors, materials, and finishes available to meet installation requirements

Sensor Heads

- Non-intrusive - backside contacts for minimal flow disturbance
- Standard stainless steel cylindrical housings available with detachable cable and optional shoulder/key for alignment
- Custom housing form factors, materials, and finishes available
- Integrated 1x4 arrays now available
- Suite of six sensor models available for different applications (see specifications table)



The CSU provides low-noise power and bias voltages to the sensor head and conditions the analog voltage signal for output to a DAQ

Capacitive Sensor Unit (CSU)

- Enables simultaneous mean and fluctuating capacitive sensor measurements
- Available as a rack-mountable 2U standalone unit or 3U PXI/CompactPCI® module
- Standalone unit provides low-noise AC and rechargeable Li-ion battery power sources and LED status indicators
- Multi-channel units also available

“CompactPCI®” is a registered trademark of the PCI Industrial Computer Manufacturers Group.

Sensor Model	Shear Stress [Pa]	Bandwidth [kHz]	Element Size [mm] x [mm]	Sensitivity [mV/Pa]	Resolution [mPa]
CS-0510	10	0.75	2 x 0.5	100	0.1
CS-0110	50	1.5	2 x 0.4	40	0.1
CS-0610	100	2.5	2 x 0.4	10	1
CS-0210	300	5	1 x 0.2	1	1
CS-0310	1000	10	0.5 x 0.15	0.3	5
CS-0410	5000	20	0.5 x 0.15	0.08	10

Now Available For Purchase

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DirectShear™ Optical

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)
- Optimized Optical Sensor Unit (OSU) 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 – no heat transfer calibration
- Harsh environment capable
- Non-intrusive – minimal flow disturbance
- High resolution, dynamic range and bandwidth
- Immune to EMI
- Highly accurate, quantitative measurements

DirectShear™ Optical Sensors



Micromachined floating element sensor heads comprised of Silicon/Pyrex



The OSU 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

Optical Sensor Unit (OSU)

- Enables simultaneous 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
- Rack-mountable 2U standalone unit

Sensor Model	Shear Stress [Pa]	Bandwidth [kHz]	Element Size [mm] x [mm]	Sensitivity [mV/Pa]	Resolution [mPa]
OS-0510	10	0.8	1.5 x 0.7	190	0.1
OS-0110	50	1.8	1 x 0.7	40	0.5
OS-0610	100	2.5	1 x 1	20	1
OS-0210	300	5	0.4 x 0.4	5	2
OS-0310	1000	10	0.3 x 0.3	1.3	10
OS-0410	5000	20	0.3 x 0.3	0.3	50

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