

# Fiber Optic Sensor for Leaf Tip Timing



## Summary of Content

Fiber optic sensors provide a high-precision, non-contact method for measuring blade tip timing and vibrations in rotating machinery.

### Overview of Leaf Tip Timing

Leaf tip timing (BTT) is a technique used to measure the vibration and arrival time of rotating blades by comparing the actual blade passage with the theoretical timing. This method is critical for assessing blade fatigue, detecting cracks, and predicting failures in turbines and other high-speed rotors. Unlike traditional strain gauges, fiber optic sensors allow non-contact measurements, reducing the influence of sensor mass and eliminating the need for telemetry or slip rings.

### Fiber Optic Sensor Principles

Fiber optic sensors for tip timing typically use reflective intensity-modulated or laser-based optical probes. The sensor emits light toward the blade tip, and the reflected light is collected via optical fibers and directed to a detector. The time of arrival of the reflected signal indicates the blade tip position. Deviations from the expected arrival time reveal blade deflection or vibration amplitude. Key advantages of fiber optic sensors include:

- High sensitivity and resolution, capable of detecting microsecond-level timing differences
- Immunity to electromagnetic interference, making them suitable for harsh environments
- Compact size and reduced weight, allowing installation in tight spaces

## Article Content

Real-time bilevel algorithm for blade tip clearance and tip timing ...

Designed for optical probe signals in the fan and compressor sections of aircraft engines. Enables real-time

Tip timing measurements using fiber optic probes

SEDI-ATI offers fiber optic on/off probes consisting of bundles of optical fibers resistant to +600°C in order

An Optical Fiber Bundle Sensor for Tip Clearance and Tip Timing ...

When it comes to measuring blade-tip clearance or blade-tip timing in turbines, reflective intensity-modulated optical fiber sensors

Tip-Timing

Tip-Timing or blade deformation measurement is applied to turbines and the use of fibre optic sensors provides a fast and reliable

Tip timing measurements using fiber optic probes

Multi-fiber link for complex environments SEDI-ATI offers fiber optic on/off probes consisting of bundles of

A comprehensive review on blade tip timing-based health monitoring ...

Garcia et al. designed an optical fiber bundle sensor for tip clearance and tip timing measurements and the sensing

Tip Timing – Institute of Turbomachinery and Fluid Dynamics – Leibniz ...

The system present at the TFD is an optical laser measurement method that works according to the light barrier principle. Several

Measurement of multiple physical quantities based on blade tip timing

Abstract Novel methods are proposed to expand the capability of a blade tip timing (BTT) system. Simultaneously

Real-time bilevel algorithm for blade tip clearance and tip timing ...

The results demonstrate its suitability for real-time implementation and its effectiveness in estimating blade tip

Turbine-blade tip clearance and tip timing measurements using an ...

BTT and tip clearance non-contact measurements are accomplished using this optical sensor, the system also gets information of all

An algorithm to optimize the optical sensor design for tip clearance ...

In this work, an algorithm for the optimization of the design of an optical fiber bundle displacement sensor for Tip

Fiber Optic Sensors: Fundamentals, Principles & Applications

Extrinsic Fiber Optic Sensors Fiber is Only an Information Carrier To and From a Black Box Light Signal Generation in Black Box

An Optical Fiber Measurement System for Blade Tip

The optical fiber tip clearance measurement system consists of the reflective intensity

Signal processing method of increasing precision of optical fiber ...

Traditional processing algorithm of the tip-timing signal of an optical fiber sensor probe is to input the output signal of

Research for Tip-Timing Sensor Based on Optical Fiber Technology

The blade tip-timing has become an effective new method to measure the in-situ vibration at turbo-machinery rotor blade tips. The

Test rig and installation of fiber optical tip timing sensors.

Download scientific diagram | Test rig and installation of fiber optical tip timing sensors. from publication:

Using a Fiber Optical Tip Timing Sensor

The optical fiber tip timing sensor used in this paper consists of a transmitting fiber in the center of the probe head and six receiving

A Blade Tip Timing Method Based on a Microwave Sensor

Blade tip timing is an effective method for blade vibration measurements in turbomachinery. This method is increasing

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Method to improve the blade tip-timing accuracy of fiber bundle sensor ...

Method to improve the blade tip-timing accuracy of fiber bundle sensor under varying tip clearance Optical Engineering

Method to improve the blade tip-timing accuracy of fiber bundle sensor ...

Abstract Blade vibration measurement based on the blade tip-timing method has become an industry-standard

Tip Timing – Institute of Turbomachinery and Fluid Dynamics – Leibniz ...

Several sensors mounted around the circumference in the housing emit a laser beam that is reflected by the blade tip as it passes

Turbine-blade tip clearance and tip timing measurements using an ...

The optical fiber bundle sensor overcomes limitations of traditional sensors for tip timing and clearance measurements. Blade-tip

An Optical Fiber Bundle Sensor for Tip Clearance and Tip Timing ...

With this approach, both blade-tip timing and tip clearance measurements can be carried out simultaneously. The results obtained on

Low-cost current, tip timing and tip clearance measurement sensors ...

Trifurcated optical fiber bundle and cross sections of its legs. Calibration curve of the tip timing and tip clearance sensor.

An eddy current-fiber optic composite sensor for simultaneous blade

In this paper, an eddy current-fiber optic composite sensor is proposed to achieve co-located and simultaneous measurement of

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