Philtec Application Note Vol. 6, No. 15

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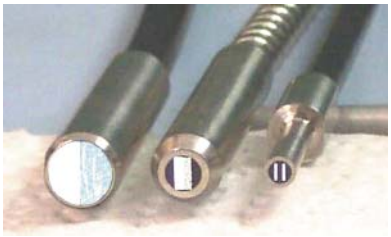
Small Moving Targets

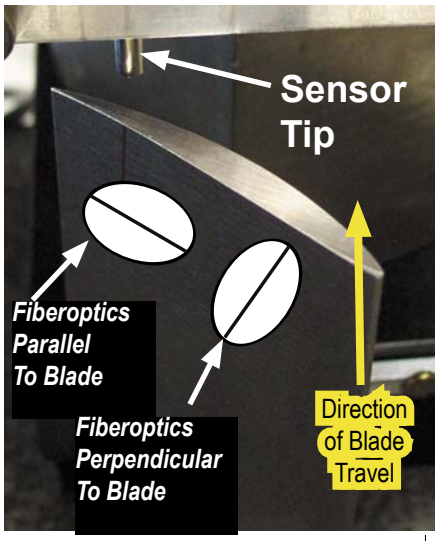


Reflectance Compensated (RC type) sensors are required in applications where the target moves sideways or rotates past the sensor tip. RC sensors have adjacent fiber bundles in their tips; semi-circular and rectangular arrangements are used. Light is transmitted to the target thru one of the bundles. The reflected light is captured in both of the adjacent bundles, following independent paths back to the sensor electronics. A ratiometric calculation provides the distance measurement which is independent of target reflectivity variations; i.e., **reflectance compensated.**

The orientation of the sensor tip should be considered when the target is discontinuous... With side-by-side fiber bundles in the RC tips, tips can be positioned (with the fiberoptics) parallel or perpendicular to the direction of motion of the target. The most favorable orientation depends upon the application.

Example

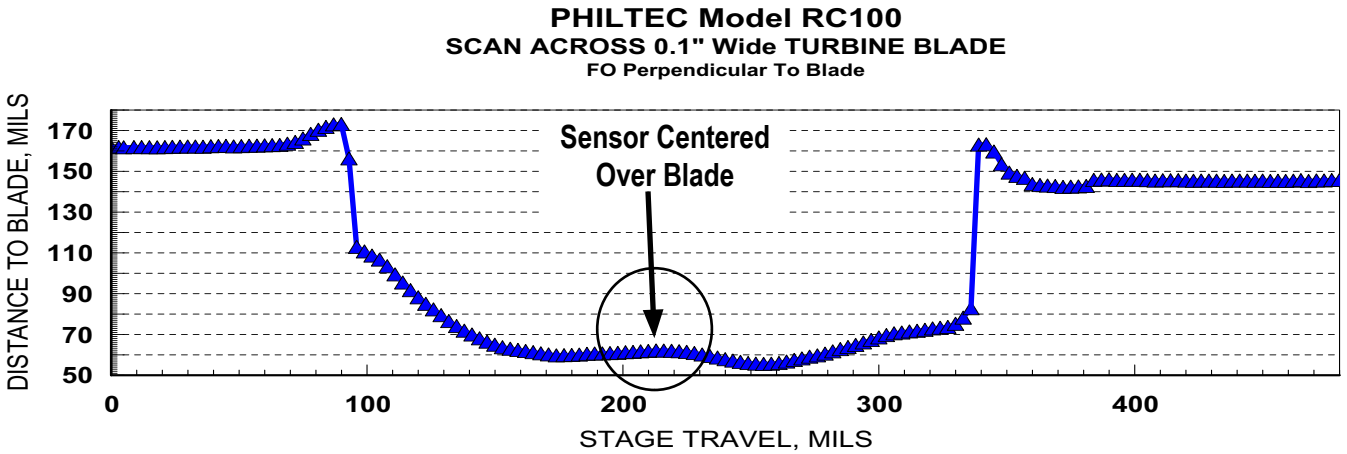
The measurement of turbine blade tip clearance.



A turbine blade and a sensor tip are shown in the picture. The sensor is an RC100 which has a round fiber bundle of 0.100" diameter. The blade thickness at the sensor location is only as wide as the sensor spot size: 0.100"

The sensor tip can be fixtured so the adjacent fiberoptics are mounted either parallel to or perpendicular to the edge of the blade tip.

The perpendicular orientation is favorable in this case. *When the fiberoptics are **perpendicular to the edges of a moving target**, the output voltage simply rolls down to the correct value as the target edge moves across the face of the sensor.*



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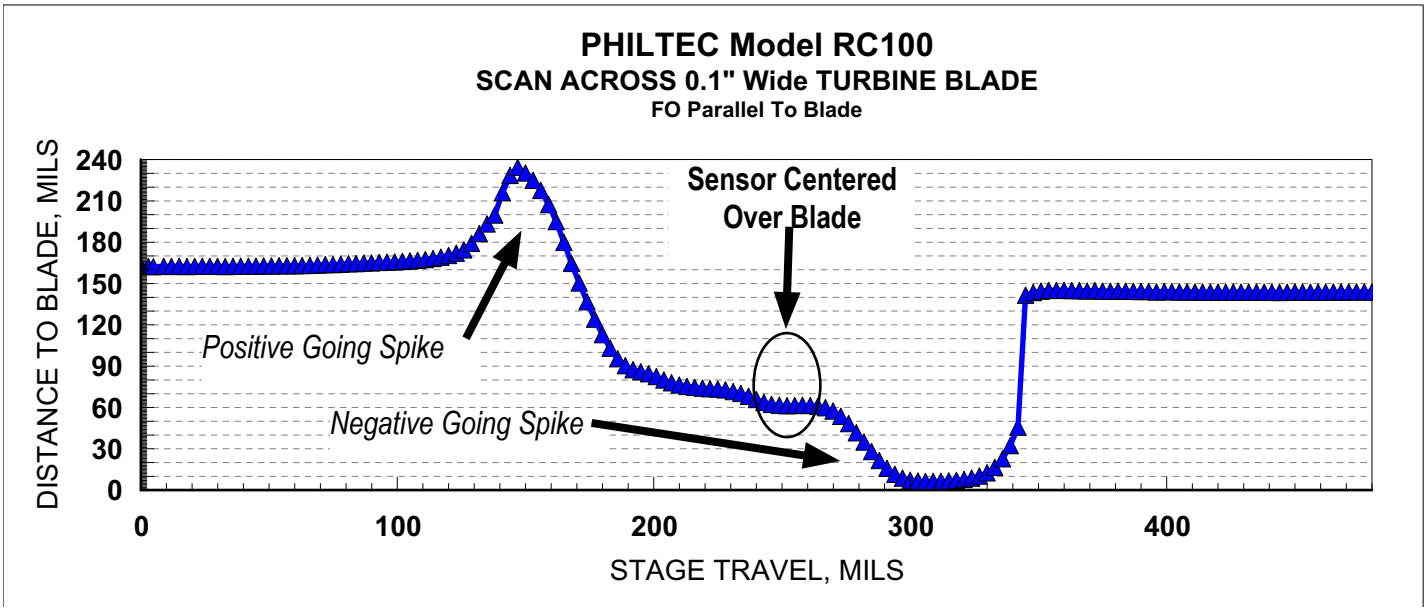
Small Moving Targets - cont'd

*When the fiberoptics are **parallel to the edges of a moving target,** the output voltage will spike to a high or to a low voltage as its leading and trailing edges move across an RC sensor tip. This effect is shown in the chart below.*



These voltage spikes will occur because the ratio of the two adjacent fiberoptics is being processed in the electronics, and that ratio will tend to go to zero when the numerator signal goes to zero, and it will tend to go high when the denominator signal goes to zero.

So, with discontinuous parts measurements, such as the measurement of turbine blade clearance, when the target surfaces pass under the sensor tip, there will always be a positive going voltage spike followed by a negative going spike (or vice-versa) depending upon the orientation of the sensor and the direction of motion.

There is an advantage to orienting the sensor tip to generate such voltage spiking: the voltage spike is fast rising and can be used to more precisely time the occurence of an event such as the beginning or the end of a part or a process.