

## Measuring Machining Imperfections and Runout in Automobile Wheel Spindles



### Introduction

A cylindrical grinding process finishes most wheel spindle surfaces. It is essential that this grinding process leave a surface finish that is smooth and free of defects with minimal runout. Any defects or “chatter” marks left on the surface can lead to premature bearing failure, unwanted noise and nuisance vibrations.

### The Problem

No grinder produces a perfect surface. Grinder wheel runout, improperly dressed wheels and fixture vibrations can cause chatter on the spindle surface finish. Chatter is a series of microscopic, repetitive imperfections, or waves, in the surface of the material being machined. A large, Tier 1 Supplier to the automotive industry approached MTII looking for a method to measure and classify these imperfections as a 100% quality control check. They required a production environment sensor that had small spatial resolution, high frequency response and large standoff distance for easy loading and unloading of parts. Additionally, the measurement accuracy had to be less than 4 micro-inches (0.1 microns) with a resolution of 1 micro-inch (0.025 microns), or better, in order to properly quantify the defects. System noise had to be kept to a minimum in order to prevent unnecessary parts rejection and scrap.

### The Solution

MTII worked closely with the manufacturer and arrived at a unique capacitance sensor design to fulfill the project requirements. The probe design incorporated a rectangular sensing element with an area of 0.020” x 0.10” (0.5 mm x 2.5 mm) and a measurement range of 0.25-mm. Several different tip designs were provided utilizing either a radiussed or chamfered face in order to accommodate a number of different wheel spindle configurations. The probes were used in conjunction with the Accumeasure 9000, an ultra high-resolution capacitance amplifier. Built in digital displays quickly alerted the operator in real time of the test results. connector provides “real-time” output waveform data. This waveform can be analyzed to determine frequency, amplitude and consistency of the horn output, which is helpful in analyzing new horn designs as well as detecting horn defects.



## The Results

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The system was able to quickly measure, sort, and thus pass or reject each spindle measured. This early process check not only improved throughput, but also prevented poor quality parts from further machining steps, saving thousands of dollars in the first month of operation. By working closely with this supplier, additional applications such as wheel flange runout and wheel bolt position have been solved with similar techniques.

MTI Instruments Inc offers several styles and types of non-contact capacitance sensors. The passive probes offer excellent thermal stability and are capable of temperatures in excess of 600°C. MTII also manufactures high precision laser and fiber-optic systems with resolutions to 0.04 micro-inch (1 nm) and frequency responses to 500 kHz. Contact MTI's experienced Application Engineers for solutions to your difficult measurement needs.