



Surface Grinder Monitoring using the WaveBook

Industrial

Application Note #21

Three primary parameters affect the performance and safety of machine-shop equipment—vibration, breaking force, and acoustic emission. A leading manufacturer of ceramic wheels for precision surface grinders uses a high-speed, portable PC-based data acquisition system to monitor these parameters on multiple units in an industrial environment.

Application Summary

Precision surface grinding machines can produce perfectly flat and/or smooth machine-part surfaces. In order to produce precision machine parts, these grinding machines must use grinding wheels whose dimensions are perfectly suited to the task. The grinding machine spins the grinding wheel very fast and holds it perfectly in place as the machine's

precision translation table moves the part being ground underneath the grinding wheel. Precision surface grinders are capable of removing as little as one ten-thousandth of an inch or less of material on each pass over a part.

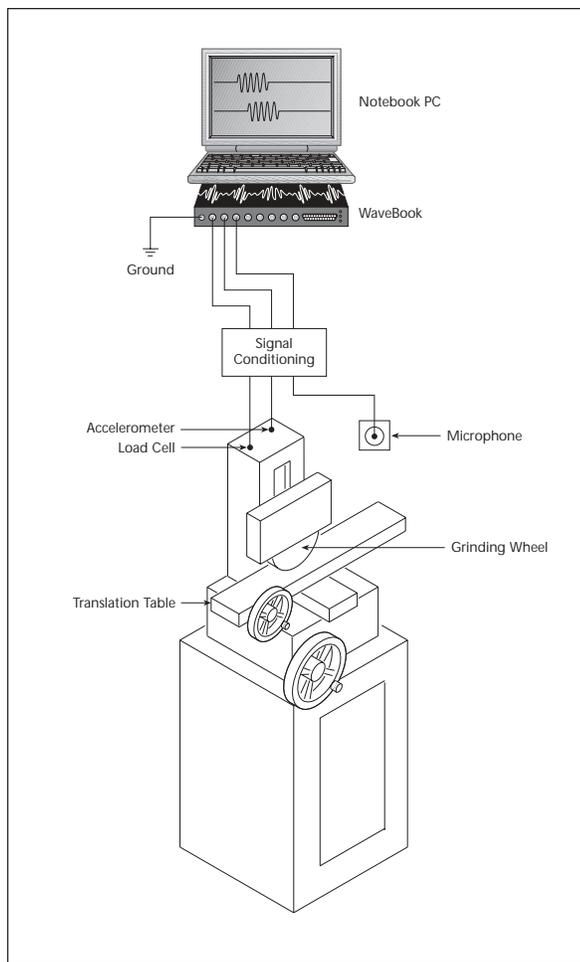
Precision grinding wheel manufacturers must ensure that the grinding wheels produced are completely uniform in diameter, thickness, and coarseness.

If a flaw in the manufacturing process of the grinding wheel results in its having more mass on one side of its rotational axis than the other, then the wheel will be out of balance and vibrate as it spins. Vibration not only reduces the longevity of a grinding machine's bearings, it causes serious imperfections in the machined surfaces and can also lead to machine-operator injuries.

The amount of force that a wheel can be subjected to before it disintegrates is of great concern, especially for machine-operator safety. If a wheel begins to break apart as it spins, the grinding machine will spew ceramic splinters, which can damage the part being machined and pose a serious danger for the machine operator.

Coarseness or granularity is also a critical characteristic of a quality grinding wheel. If a grinding wheel is uneven, the quality of the surface being ground is affected. One way to measure the grinding wheel's coarseness is to analyze the audio signal produced when the wheel is grinding a material. Differing levels of coarseness produce distinct audio signals.

To monitor these important, critical parameters, the precision grinding wheel manufacturer uses a high-speed, portable PC-based data acquisition system that is capable of saving this data to disk for post-acquisition analysis. The data acquisition system validates the design of new ceramic grinding wheels and also checks the quality of existing models by ensuring that the lot being produced meets the manufacturer's specifications. By attaching an accelerometer and a load cell to the arm of each surface grinder under test, the manufacturer records a magnitude of vibrations induced by a wheel's imperfections and the force being applied to it. The manufacturer also verifies a wheel's coarseness by analyzing its audio spectrum.



The portable surface grinder monitor set-up



Potential Solution

Originally, the grinding wheel manufacturer evaluated A/D plug-in boards, which install in a desktop PC. This solution proved to be far too bulky and difficult to transport to each precision grinding machine test unit. Also, the manufacturer did not want to purchase software that required programming to obtain the desired data.

IOtech's Solution

The manufacturer found a complete solution in the **WaveBook** digitizer, which includes Windows-based **WaveView** software at no extra charge. The WaveBook's small size and BNC connectors enable the manufacturer to quickly move and set up the data acquisition system at precision grinding machine test stands as needed. What's more, the included **WaveView** software enables the manufacturer to record the desired data without any time-consuming software programming.

Conclusion

The combination of easy-to-use included Windows-based software and the portability and size of the **WaveBook** make it the perfect data acquisition solution for this application, as well as many other industrial applications.

WaveBook Series

The WaveBook™ series of portable and desktop digitizers offer multi-channel waveform acquisition and analysis for portable or laboratory applications. All WaveBook models include 8 built-in channels expandable up to 72 channels of voltage, accelerometer, microphone, strain gage, thermocouple, position encoder, frequency, high voltage, and other signal types. For applications beyond 72 channels, up to four WaveBooks can be combined within one measurement system, for a total capacity of 288 channels. WaveBooks are available with either an Ethernet or parallel connection to a PC.

Features

- PC connection via Ethernet, parallel, PC-Card, or PCI card
- 1 μ s/channel scanning of any combination of channels
- Expandable up to 288 high-speed channels
- SYNC connection allows multiple units to measure synchronously
- Add up to 224 lower-speed thermocouple channels
- DSP-based design provides real-time digital calibration on all channels
- Single and multichannel analog triggering with programmable level and slope
- Digital TTL-level and pattern triggering
- Pulse trigger and external clock
- Programmable pre- and post-trigger sampling rates
- Sixteen 1-MHz digital inputs
- Operable from AC line, a 10 to 30 VDC source, such as a car battery, or optional compact rechargeable battery module



Using WaveView software's spreadsheet-style interface, you can easily set up your application and begin taking data within minutes of connecting your hardware, with no programming required.

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Included Software

- WaveView™ for *Out-of-the-Box™* setup, acquisition, and real-time display:
 - Scope mode for real-time waveform display
 - Logger mode for continuous streaming to disk
- eZ-Analyst™ for real-time spectrum analysis
- Export data in third-party formats
- Includes drivers for Visual Basic®, Delphi™, C++ for Windows®, DASYLab®, and LabVIEW®
- ActiveX/COM development tools