Remote Turbine Vibration Monitoring
using the ZonicBook

Application Summary

Numerous electrical generators owned by a major U.S. utility company help supply energy needed for the power distribution grid spread across the North American continent. And the turbine-driven generators must continuously run smoothly without much vibration; otherwise they could sustain significant damage. Machine downtime costs could easily run in the thousands of dollars per hour. So, to keep the systems up and trouble free, their vibration signatures are recorded endlessly. The experts who watch over the equipment can frequently detect an imminent failure just by noticing changes in the shape of the waveform. The data acquisition equipment that monitors the health of these generators is permanently connected to vibration sensors including displacement transducers and proximity probes strategically placed around the generators, particularly to monitor shaft vibrations on the bearings. A critical requirement is that the equipment ties into the plant's DCS (distributed control system) and provides remote monitoring.

A major utility company uses IOtech's ZonicBook and eZ-TOMAS software to capture generator and exciter vibration signals on a gas-turbine-powered machine. The waveforms are typical displays of historical data that engineers need to monitor trends over time. Any subtle changes in the data as seen through the eyes of an expert can be enough information to alert the maintenance engineers of possible failures.
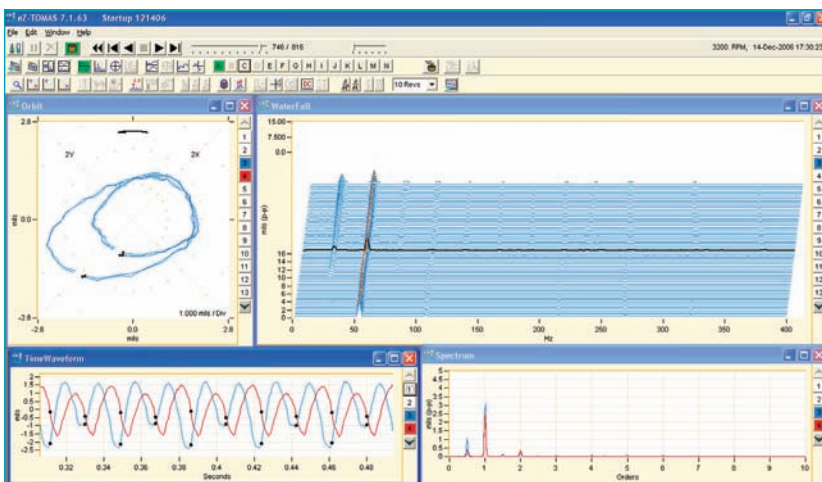
Potential Solution

The data acquisition equipment that the utility company used initially is relatively expensive and has some serious operational shortcomings. The system hardware is large, not easily transportable, does not have remote monitoring capability, shows only the RMS amplitude of the signals, and is unable to show an adequate level of waveform detail to help the engineers detect an impending failure. It does not provide signature analyses or FFTs.

IOtech's Solution

Because of these limitations, the utility company is now supplementing the old equipment with two 8-channel, ZonicBooks and its companion eZ-TOMAS software. According to the Outage Services Manager, "We primarily bought the ZonicBooks to measure shaft vibrations before and after an outage. Our secondary use is to remotely measure vibration levels and signatures. We can tie into the plant's DCS via our server and see what the direct amplitudes are. But without the ZonicBook, we can't remotely monitor phase angle, one, two, or three-times amplitudes, and more discrete parts of the vibration signal." He also emphasizes that it's easy to say there's a problem when the vibration is increasing, but being able to see what part of the vibration signal or amplitude component is changing is the most important aspect for diagnostics. The engineers monitor the signals over a period of time, so they can see what's developing and how rapidly.

The ZonicBook's output connects to a laptop computer at the turbine site, which is used as a server on the network. The engineers can remotely access the server's output from another location via the network neighborhood to observe the systems vibration activity. The ZonicBook itself, like the original data acquisition system, connects to sensors at the turbine generator site. The engineers connect them to the existing monitor and control panels, access and record the data, and then examine the acquired data.

Alternatively, they return to the office with the ZonicBook and computer, observe and analyze the data, and then decide what must be done. For example, the engineers use the information to calculate the weight

and location for applying balance shot. Then they return to the site to install it or make other changes necessary to solve the problem. After installing the balance shot, or otherwise repairing the machine, they restart the machine and record another set of data. If the data are good, they solved the problem.

When a balance problem has been pin-pointed in a combustion or steam turbine, the one-time amplitude and phase angles have to be observed and analyzed. The eZ-TOMAS software isn't used to calculate a shot directly, but it can break down the direct reading into various components, and then that information is used to calculate or plot the location and size of the needed balance weight.

For the present time, all the IOtech equipment is on-site. The engineers are familiar enough with the ZonicBook to set it up and collect the discrete vibration component data needed to be analyzed, but they would like to program the system so the ZonicBook could be remotely located or controlled. "There is sure to be a learning curve because it involves networking and a little higher level IT information," says the Outage Services Manager, "but with the very complete instructions that came with the manual, the engineers should be able to figure it out quite easily. They are in the process of doing that right now."

Conclusion

The IOtech equipment is performing well at each site for the utility company. The major advantage is the ZonicBook's portability. In addition to the displacement transducers and proximity sensors, the company runs a few Aero-Derivative engines that use accelerometers, velocity pickups, or seismic probes, all of which can be analyzed by the ZonicBook, but most of the new generators are outfitted with proximity probes and built-in displacement transducers.

ZonicBook/618E

Vibration analysis and monitoring has never been easier than with the ZonicBook/618E and eZ-Series analysis and monitoring software. The ZonicBook leverages 30+ years of experience providing vibration measurement solutions. This Ethernet-based solution adds another dimension — the *low cost,* full-featured 8 to 56 channel analyzer available. The ZonicBook hardware is the signal conditioning and acquisition engine, while the eZ-Series software in the PC defines the specific analysis and monitoring features of the system.

Features

- 8 dynamic input channels, expandable up to 56 channels
- 4 tachometer channels for rotational measurements
- High-speed Ethernet connection to the PC for continuous recording
- eZ-Series software packages address a wide variety of vibration monitoring and analysis applications
- TEDS support for accelerometers

The ZonicBook/618E with eZ-Series software and your PC makes a real-time, portable vibration analysis monitoring system

Software Overview

Various software packages are available for the ZonicBook, each tailored to a particular vibration measurement and analysis application. Choose the package that suits your application now, and upgrade to additional packages as your requirements evolve.

- **eZ-Analyst** provides real-time multi-channel vibration analysis, including overlay of previously acquired data while acquiring new data, strip charts of the throughput data files, cross channel analysis, and direct export to the most popular MODAL analysis packages, ME Scope and Star Modal.

- **eZ-TOMAS & eZ-TOMAS Remote** are highly sophisticated, yet easy-to-use tools for the monitoring and analysis of single or multiple machines, which allows the user to assess the reliability and operation of his process, and the critical machines pertaining to his process.

- **eZ-Balance** is used to balance rotating machinery with up to seven planes. A balance toolkit, including Split Weight calculations, supports the balance process. The balance vectors are displayed on a polar plot so the user has a visual indication of the improvement. Time and spectrum plots show detailed vibration measurement during the balance process.

- **eZ-NDT** package is exclusively used in production applications to determine the quality of composite-metal products at production rates of 1 part per second.
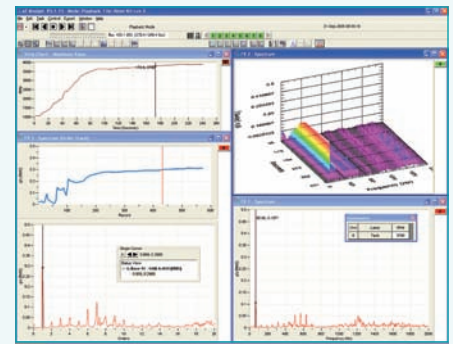
eZ-Analyst adds real-time continuous and transient data acquisition in the time, frequency, or order domain
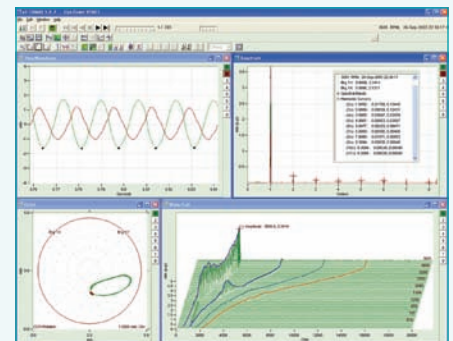
View Time-Domain, Spectrum, Waterfall, and Trend simultaneously on one screen with eZ-TOMAS

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