IRIS M Motion Amplification Camera - Seeing is Believing

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Since the last decade, the vibration community has not seen any revolutionary changes in the methodology and technology related to vibration. Perhaps, since we are now in the Industry 4.0, the only upgraded technology is the wireless sensor.

Generally, in a vibration measurement tool, it consists of at least three items; a vibration sensor, a cable and a vibration analyser. For the most basic vibration measurement on a simple rotating machine (i.e. electric motor), it needs at least six measurements. Three measurements are made for driven end (DE) direction and another three at non-driven end (NDE) direction as illustrated in Figure 2.

Figure 1 : Example of a portable vibration measurement system (Credits to Motionics)

Figure 2 : Figurative representation of vibration measurement directions on a rotating equipment

We can actually reduce the number of measurements by using a tri-axial sensor. Thus, only two measurements are needed (one measurement at DE and NDE, respectively). This is generally what vibration analyst uses for a vibration measurement. Either way, the main data that an analyst obtain are the vibration time waveform and vibration spectrum. From the vibration spectrum, an analyst can extract valuable information such as the acceptability of the vibration levels, source of the vibration, root cause of the vibration, etc. This technology makes vibration analysis a very powerful tool, thus it explains why this vibration technology is still relevant until today.

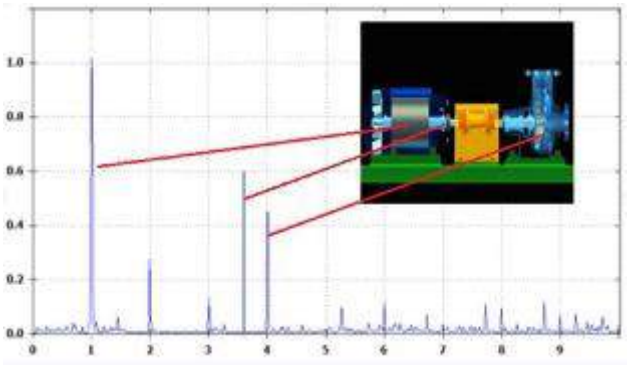

Figure 3 : Example of vibration spectrum (Credits to Fluke)

During the vibration troubleshooting, a more advanced measurement method is often used. It is called as the Operational Deflection Shapes (ODS). The idea is not only to gather the vibration data, but also to visualize the motion of the vibrating asset. By visualizing the vibration shapes, we can easily define the best way to mitigate the vibration issue. ODS is a very powerful tool for vibration troubleshooting, especially when it comes to structural and piping issue. However, internal issues, such as gear meshing and rotor/stator problem, are not suitable for ODS.

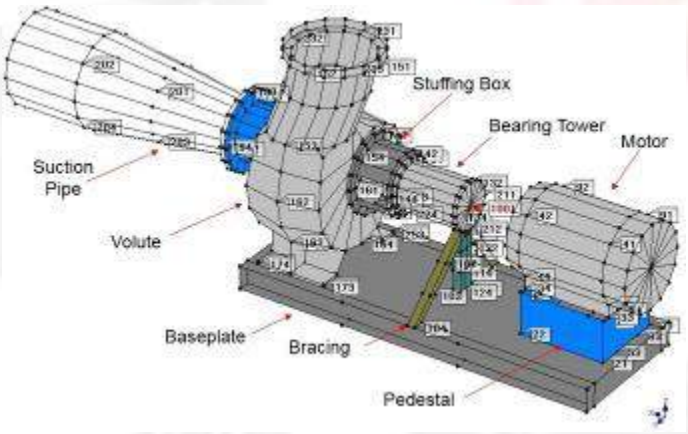

Figure 4 : Example of an ODS (credits to Mechanical Solutions Inc.)

The traditional approach for measuring and evaluating ODS is by using several vibration sensors and multi-channel analyser (Figure 4). The more sensors are used, the more accurate the representation of the asset can be acquired. Hence, more accurate vibration data can be obtained. However, more sensors and analysers are needed which makes the setup for the measurement for each equipment, structure and pipe time consuming. At the same time, the capital investment is quite significant. Furthermore, the need to use the additional software to perform the analysis (in the office) will further lengthen the whole project duration.

This is where IRIS M Motion Amplification Camera comes in…

IRIS M Motion Amplification Camera allows the user to see the vibration (hence ODS) of an equipment/ piping/ structure in near real-time. The patented camera amplifies the motion of the subject to a point where the ODS of the subject can be seen by naked eyes. The ability to visualize the whole process while retaining the component-level analysis makes IRIS M the perfect tool for screening, troubleshooting and commissioning.

As it is just a video recording, the measurement is totally non-contact. Thus, it is suitable for the following applications:

- Difficult surface to mount sensor (High temperature, wet, non-metallic material, etc.)
- Difficult to reach asset (high location, non-accessible location, etc.)
- Big structures
- Rotating equipment
- Piping
- Etc.

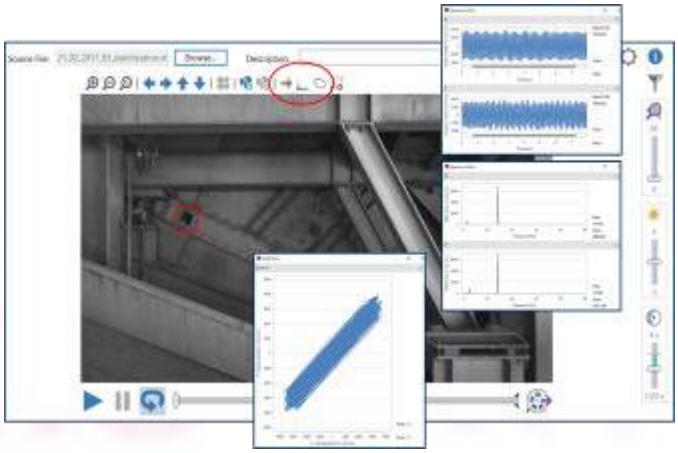

Figure 5 : Motion Amplification Software Interface

Additionally, each pixels of the video can be used as vibration sensors (Figure 5). This allows for more advanced analyses to be performed (spectrum analysis, orbit plot, time-waveform, bandwidth filtering, vibration stabilising, etc.). All these are available after just a few seconds of measurement.

The vibration level and frequency measured are as accurate as a conventional vibration sensor, as long as the distance from the camera to the measurement point is correctly measured. The reason is that, the distance measured from the camera to the asset is used as a reference for the displacement measured on each frame taken by the camera. Basically, it is a triangulation calculation from the camera to the pixel on the asset.

Figure 6 : IRIS M system consist of a HD camera, a laptop, a cable, a tripod and a couple of lenses

The setup time is a fraction of what normally required for a standard ODS measurement. Thus, more measurement can be done with less time on-site. Analysis and results can be acquired in near real-time. Therefore, solutions can be deduced and tested there and then.

So why do we need this camera? Well, for a plant owner, IRIS M Motion allows fast delivery of actionable data that can be understood by technical and non-technical personnel. As a result, equipment shutdown time due to vibration issue can be reduced significantly and efficient solution can be found relatively easily. In short, it saves money.

As for a service provider, not only it helps the consultant for finding the root cause of the high vibration, it also decreases the time needed for measurement and analysis. Consequently, the cost for the troubleshooting service can be reduced and faster results can be delivered to the client. Again, it saves money and at the same time it improves the reputation of the service provider.

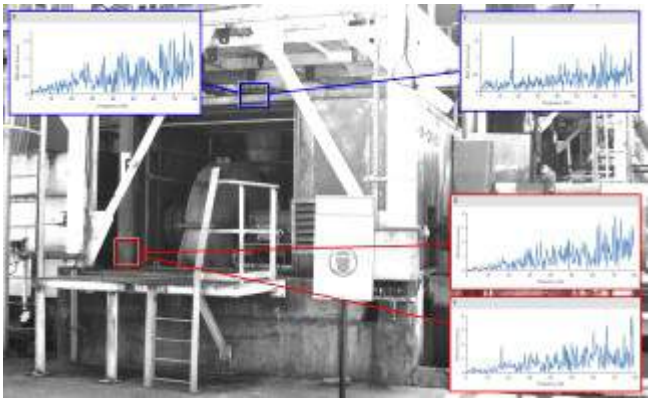

Figure 7 : Example of analysis that can be done on the video

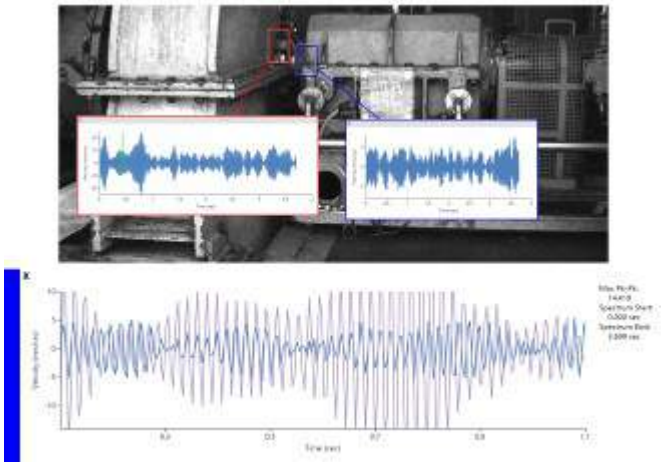

Figure 8 : Using time waveform to perform simple phase analysis

A simple method can be applied when using the camera for a vibration troubleshooting mission. To start off, a global view of the asset preferably in isometric angle is taken. This allows user to identify any problematic area on the asset for further investigations. Next, based on the results found on the global view video, the analyst can focus on the problematic area and may take another measurement from another angle.

Figure 9 : Starts with an Isometric global view of the asset

Figure 10 : Zoom in to the problematic area for a clearer view

Iris M Motion amplification camera proves that a new technology can still disrupt a mature market that has been using the same type of technologies for decades. It is totally out-of-the-box idea that can significantly help anyone in the vibration world to solve their vibration issues. And at the same time, it assists people from outside of the vibration circle to understand complex vibration issue through simple video manipulation. This makes the motion amplification technology so great.

As they say, seeing is believing…

Note: For sample videos of IRIS M Motion amplification camera, a simple search for “Motion amplification” on YouTube is sufficient.