MODAL SPACE - IN OUR OWN LITTLE WORLD *by Pete Avitabile*

Illustration by Mike Avitabile

Is it better to collect averaged FRF data for a modal test?
Or collect time data and process it afterwards?
Let's talk about the differences.

Both approaches are acceptable providing that good data is collected but time data offers many more advantages. Let's discuss some of the different aspects of collected averaged data vs. time data streamed to disk.

In the old days, the option of streaming to disk was not possible. Typically, time data was collected and immediately averaged to obtain FRF data. Generally, computer memory and disk drive capacities were very small and this necessitated the immediate processing of time data. (Actually, in the very early days of modal testing, it was very rare that all the spectra would be saved and many times only the FRF was saved - you had to think twice about anything that was saved due to the expense of storage devices.)

This was the typical mode of operation for most modal tests performed. As the data was collected, the averaged input, output and cross spectrum was available for review along with the FRF and coherence. With this approach, there was immediate information available to assure that adequate measurements were obtained. The measurements could be scrutinized after each set of measurements were collected and if necessary, additional averages could be collected to obtain improved measurements or determine what might be causing poor measurements. As each set of measurements were collected, this data review continued for each set of measurements obtained. If any problems occurred during any of the measurements acquired, there was immediate feedback through review of the FRF and coherence as to the adequacy of each measurement obtained.

Depending on the application, at times, data was collected and recorded on magnetic tape in the field at the test site. This data was then brought back to the laboratory for processing to obtained averaged FRF data.

However, the use of magnetic tape and the associated tape recording equipment, at times, introduced a wide array of different issues that could possibly contaminate some, if not all, of the data collected. While this introduced problems of its own, the advantage of having time data enabled further processing following the completion of the test. Sampling parameters could be studied to determine various signal processing effects since time data was available. This enables the test engineer to gain further insight into various aspects of the data collected. If only averaged FRF data is available, none of the additional processing is possible.

Today, it is very common to obtain time data that is directly streamed to disk. (This largely due to the availability of inexpensive large capacity disk drives.) This data is collected and then processed after the completion of the test. There is no doubt that time data is by far the best data to collect today. With time data, the same processing still needs to be performed (as is done with averaged FRF data) on the data (Figure 1). However, the time data is always available for additional processing if needed. Additional signal processing scenarios can be investigated if desired or needed. This is not possible with averaged FRF data; once the data is collected there is very little additional processing that can be performed since time data is not available once the data is processed.

Based on all the statements above, it appears fairly obvious that time data is the best data to collect. There doesn't seem to be any reason to collect anything but time data followed by whatever spectral processing is needed. In this way, any subsequent processing can be investigated and explored with the time streamed data. Once time data is available, new concepts and processing can be performed at a future data as the technology progresses. If averaged data were collected, then future processing could not be explored.

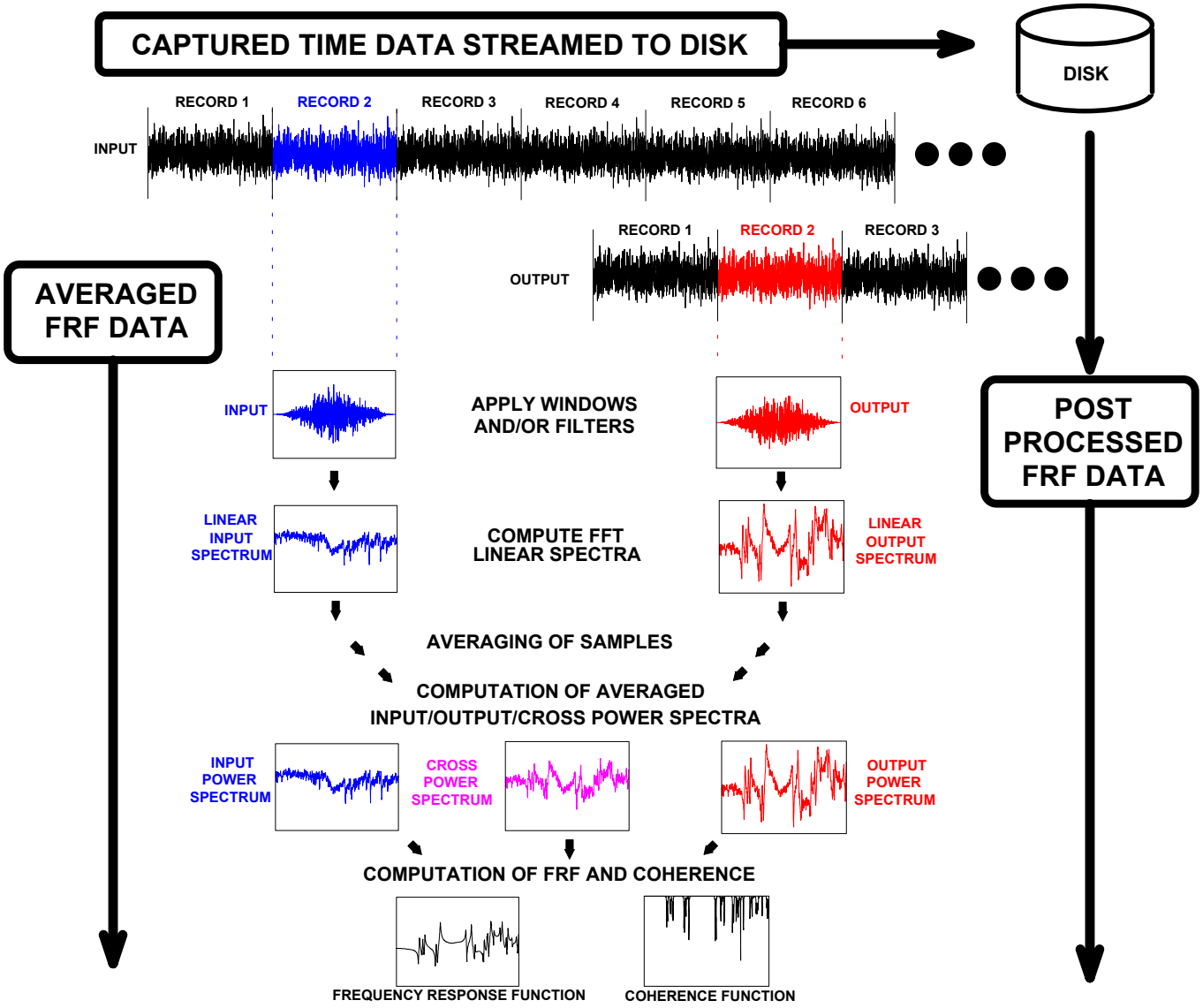

Figure 1 - Schematic Overview of Time Streamed Data to Disk vs. Averaged FRF Data

However, whenever any testing is performed, it is extremely dangerous to only collect time data. Now that may sound like a contradiction after everything that was discussed above but just hear me out. Whenever time data is collected there is no immediate spectral data that provides any information as to the adequacy of the data. All we know is that we have collected time data streamed to disk.

But how good will the processed FRFs be once the time data is processed? Has sufficient data been collected to obtain good FRFs with acceptable coherence functions? And many other statements can be raised here as to the adequacy of the time data collected. You will not know how good the data is until it is processed. You would hate to come back from an expensive field test only to find out that all the data is unacceptable!

So the rule is - collect all the time data you want but you had better process some typical data sets in the field to assure that the data collected will be acceptable. There is no substitute for viewing an FRF and coherence!!!

I hope discussion helps with time streamed data vs. averaged FRF data. If you have any more questions on modal analysis, just ask me.