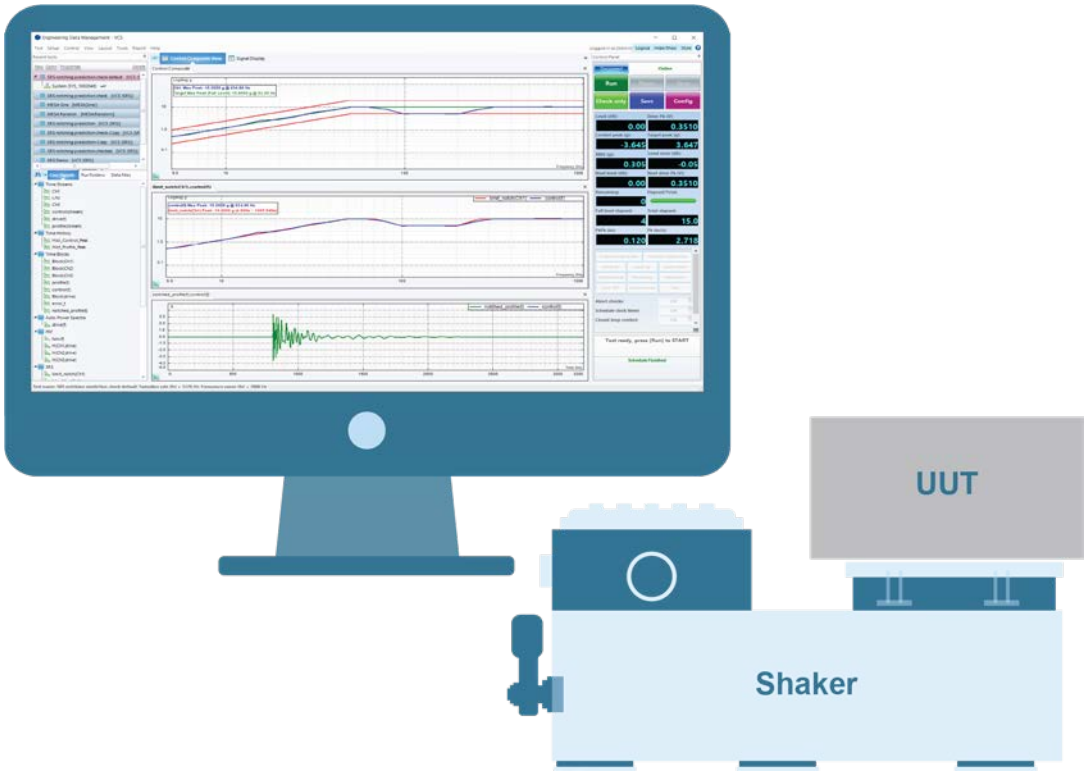
CRYSTAL INSTRUMENTS

Introducing SRS Predictive Notching

Application Note 081



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Shock Response Spectrum (SRS) testing is commonly required for defense applications. The UUTs are tested under significantly high levels of shock waveforms.

The concept of SRS predictive notching was proposed a few years ago to fully test UUTs and ensure their survival experiencing real-world vibrations while protecting it from over testing.

In Sine or Random control, notching and limiting is a common technique used to limit the response level within a certain frequency range. Previously, users were not able to limit the SRS spectrum level within a certain frequency range for any response channel. Predictive Notching provides a limiting function for any input channel. The limits are defined in the SRS domain.

Before we get into the details of SRS predictive notching, let's first review the SRS control process.

The diagram in Figure 1.1 illustrates the peak response of a time waveform applied to an array of SDOF to construct the SRS. SRS control will perform this process in the reverse order. The wavelets will be figured out so that the resulting SRS follows the required RRS. This is commonly known as the SRS synthesis process.

The following steps are preformed to carry out SRS predictive notching:

- Run low level test with assigned SRS limiting channels
- Predict full level responses and limiting conditions to compute a notched SRS profile
- Synthesize to obtain an updated time waveform based on notched profile
- Run full level test using newly synthesized waveform so that SRS follows notched profile

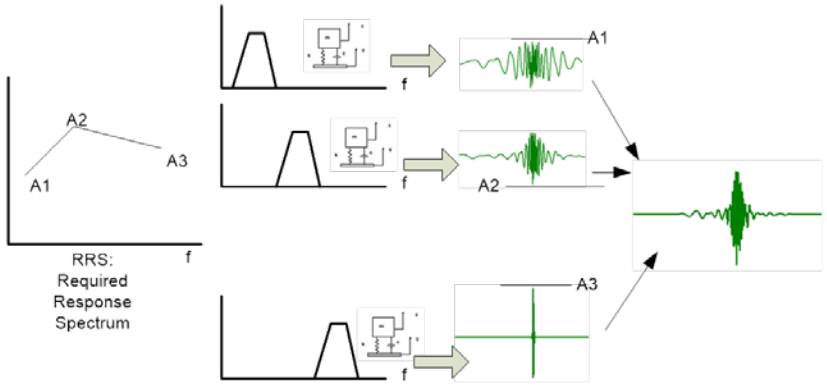

Figure 1.1

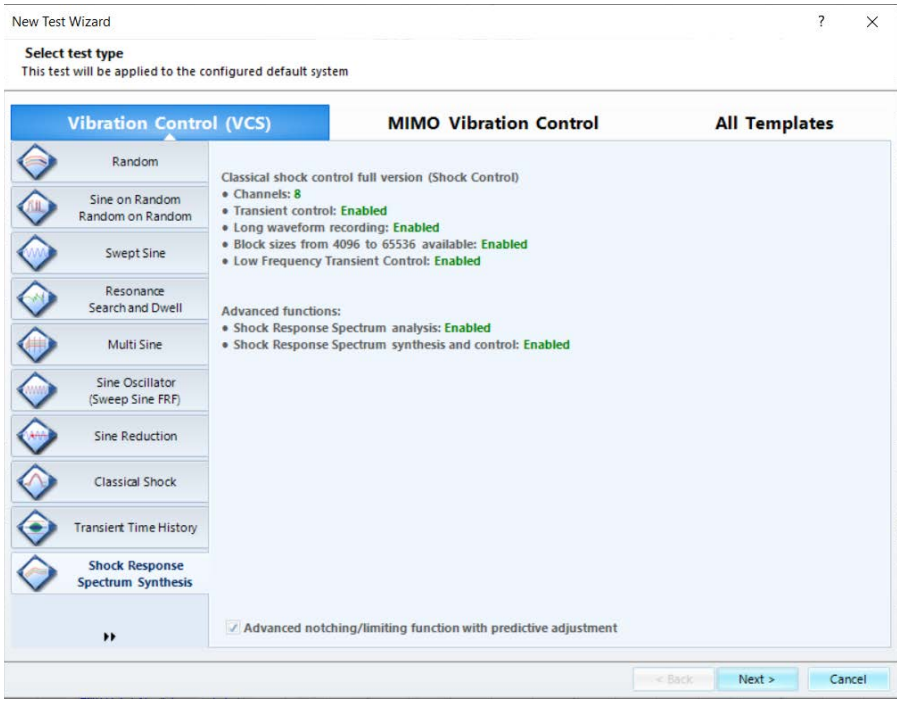

Figure 1.2

To use the SRS Predictive Notching feature, check the “Advanced notching/limiting function with predictive adjustment” box when creating a new SRS test. (Figure 1.2)

The limit profiles can be assigned to one or more input channels. Note that the control channel can also be set as a limit channel. (Figure 1.3)

“Pause and predictive notching” is included in Run Schedule. This entry is only available if the “Advanced notching/limiting function with predictive adjustment” box was checked during the new SRS test setup. (Figure 1.4)

The preceding run schedule is a typical example for SRS predictive notching tests. The first entry runs a pre-defined SRS test at a low level (e.g., -6 dB), pauses the test, and the notching predictive windows appear for users to synthesize a new time waveform. The new time waveform has an SRS following the notched SRS profile.

The last entry will run the SRS test at a full level, controlling to the notched profile.

Click “Run” to carry out the pretest. Users can click “Proceed” to start a low-level SRS test (e.g., at -6 dB).

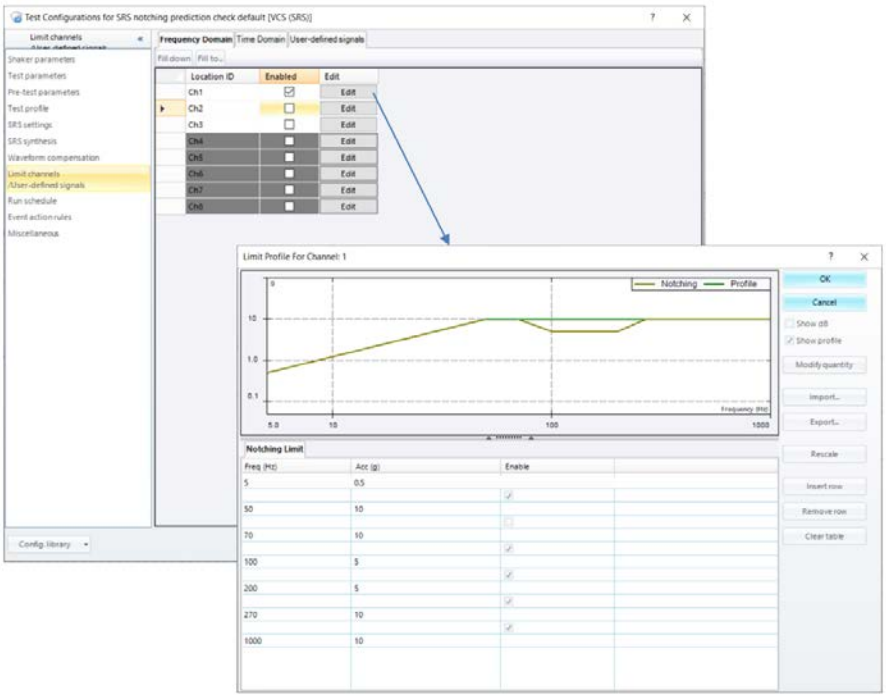

Figure 1.3

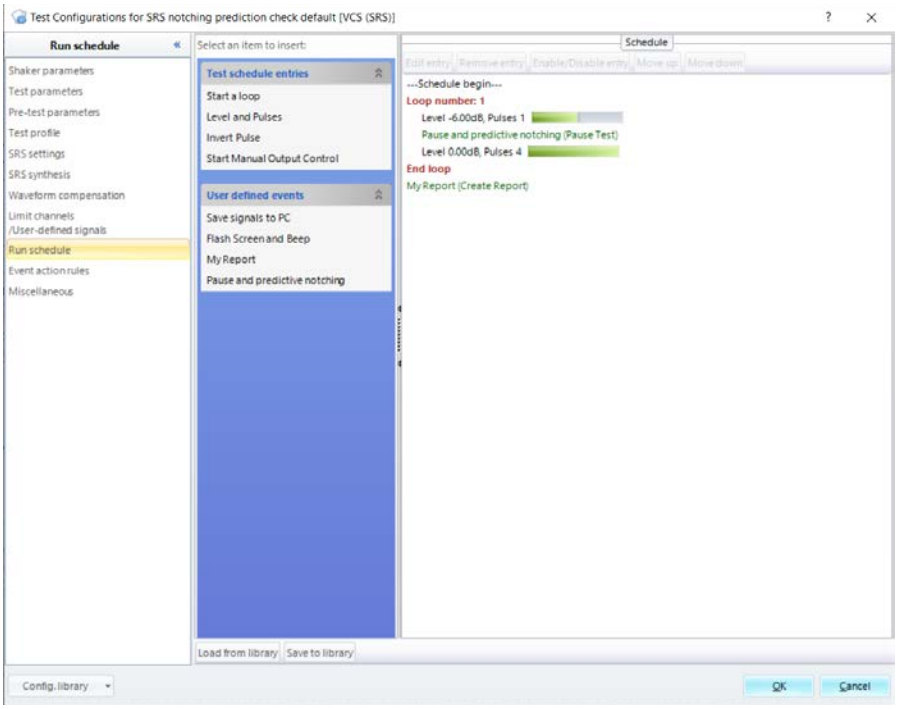

Figure 1.4

After the process is completed, the Notching window appears for users to calculate the notching profile. (Figure 1.5)

The notching profile in Figure 1.5 displays the notching profile with buttons to carry out a predictive notching calculation.

The main steps are **Synthesis** and **Compensation.**

Synthesis will run the complete SRS synthesis as usual to obtain a time waveform with its SRS following the notched SRS profile. Then, Compensation can be carried out to ensure zero velocity and zero displacement at the end of the time waveform. (Figure 1.6)

Once Synthesis and Compensation are completed, the user can click the Apply button to continue the run schedule for a full test level of 0 dB. The SRS profile is now a notched SRS profile.

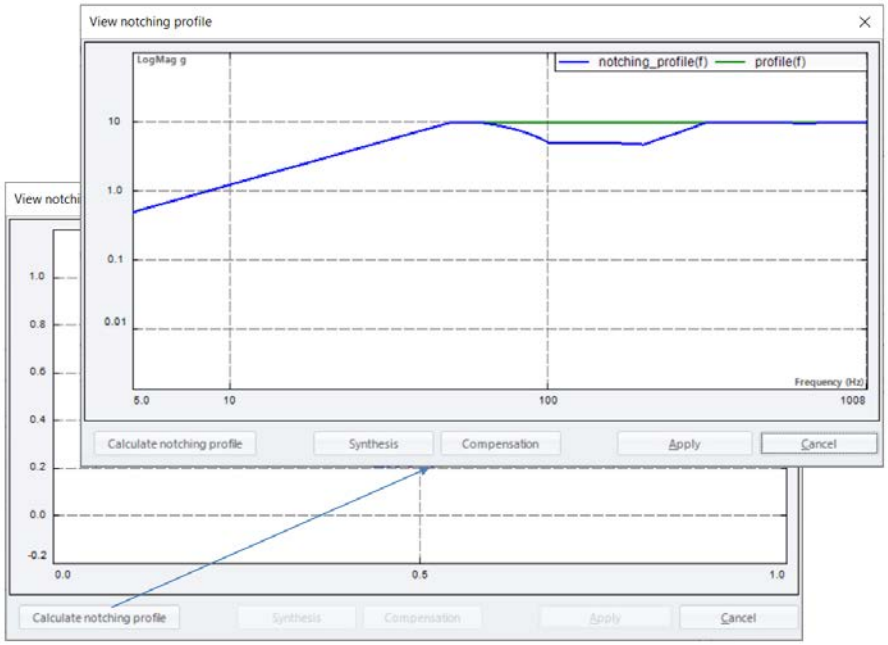

Figure 1.5

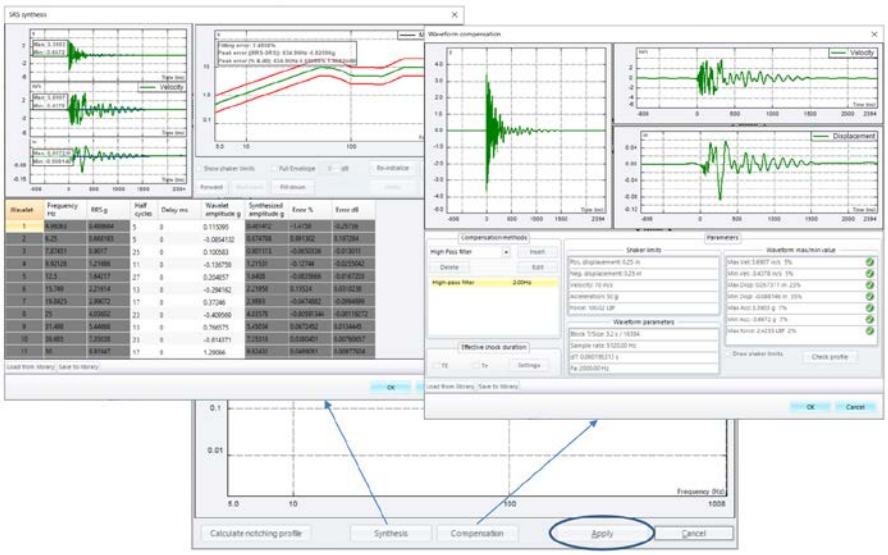

Figure 1.6

The following screenshots illustrate the SRS test carried out at full level with a notched SRS profile. (Figure 1.7)

For more details, contact the Crystal Instruments team, or visit the website: https://www.crystalinstruments.com/single-axis-vibration-testing

Figure 1.7

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