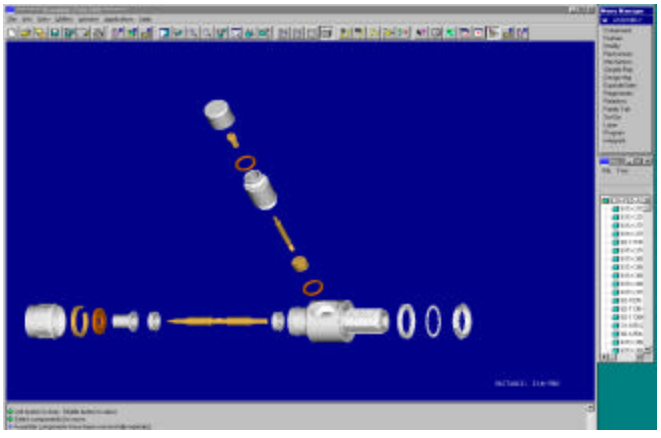
**High Frequency Structure Simulator Software Update (Additional Design Engineering Capabilities)**

**ABSTRACT:** In the previous two issues of Amphenol Signals, we introduced you to the new software tool currently in use by the design engineering department for simulating the electrical design of connectors. This software (Ansoft HFSS) has helped to dramatically reduce the time necessary for designing new connectors. The latest edition (Version 7.0) has the added capability of OPTIMETRICS. This capability allows the engineer to set up a problem to automatically vary the dimensions of specified components and determine the correct dimensions for optimum RF performance. As stated in the previous articles, all of this is done before any parts are actually made in the model shop resulting in a significant reduction in development time.

**OPTIMETRICS:** OPTIMETRICS is ANSOFT's name for a software program that will repetitively solve successive iterations of a problem while changing variables specified by the user until a desired limit is reached or the software determines that the desired limit cannot be reached. If the desired limit cannot be achieved, it will report the best possible case. The limits are normally set in terms of reflection coefficient (Return Loss or VSWR) at a specific frequency or over a range of frequencies. Not all problems lend themselves to this type of solution. Many of the common problems dealt with by the engineering department on a day to day basis can be solved without the use of OPTIMETRICS in just a few tries by varying a component's dimensions manually. However, many solutions do benefit from the use of optimization techniques especially when there are several dimensions that interact with each other, or in the opposite situation where only one dimension needs to be varied. The latter case can be optimized very quickly where as the former case can take many hours to solve. Because setting up an OPTIMETRICS problem takes more time than a simple HFSS analysis, each situation is evaluated to determine if the expenditure of the extra time is warranted. Sometimes that decision cannot be made initially but must be made only after an initial HFSS analysis is completed.

**THE PROBLEM:** A typical case benefiting from the use of OPTIMETRICS is a Quarter Wave Stub Lightning Protector. These devices operate over a narrow frequency range with the minimum reflection desired at the center of the frequency range. Generally, Return Loss must be better than –20 dB over the bandwidth of the device.



**THE SOLUTION:** Normally, an initial HFSS analysis will be performed to determine the nominal problem's performance. Figure 1

shows the mechanical drawing and Figure 2 is the HFSS Model.

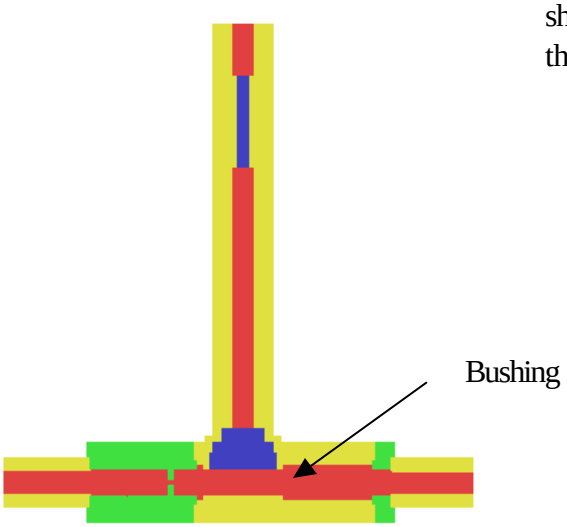



**FIGURE 1. Connector Drawing**

**FIGURE 2. HFSS Model**

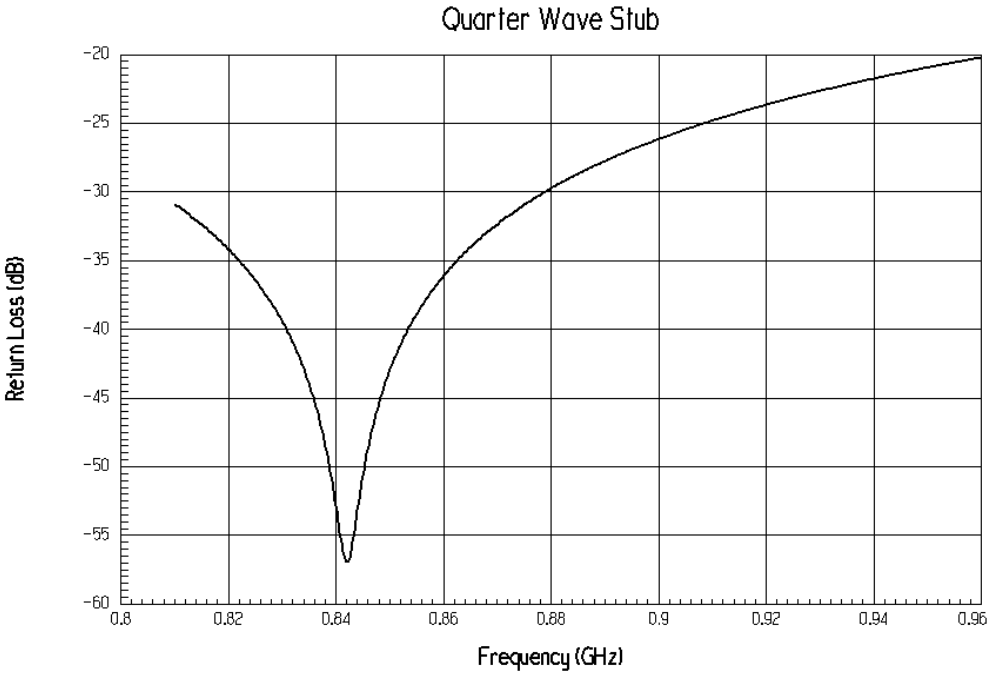



**FIGURE 3. Return Loss before OPTIMETRICS**

Figure 3 shows the initial analysis solution. We are in the ballpark but the Return Loss is just in spec with no margin for tolerances and manufacturing variations and the resonant frequency is 22 Mhz off center. Before OPTIMETRICS, we would have had to make an educated guess as to how much to vary the bushing diameter. After analyzing the next solution, we would then try again and again until we came close to the desired results. With OPTIMETRICS, we can tell the software the minimum and maximum mechanical dimensions allowable for the bushing diameters (See Figure 4). The software will then analyze the design at the extremes of these mechanical dimensions and then automatically vary the dimensions until a solution is achieved.

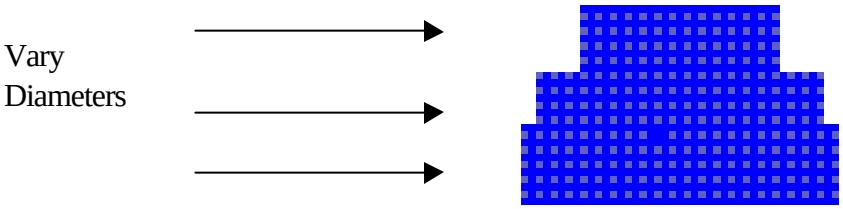



**FIGURE 4. Bushing**

**CONCLUSION:** The solution to a problem such as this can take several hours or more. The time it takes would depend on the number of variables and the level to which it must meet the Return Loss requirement. After the initial set-up of the problem, the software redraws and reanalyzes the problem with no further input needed from the engineer. Therefore, another major advantage of OPTIMETRICS is that while the software is solving the problem, the engineer is free to work on a different project. The final Return Loss results can be seen in Figure 5.