SIJ-Provided Content Webinar 2022

Title: The Use of DSP Techniques to Analyze S-Parameter Sampled Data

Presenter: Dr. Aldo Morales, Professor at Penn State Harrisburg

Overview:

S-parameter characterization of high-speed interconnect components is prone to numerical, modeling, and/or measurement errors. These errors can lead to non-physical results such as causality or passivity violations. This is a problem in modern package design where extensive signal integrity simulations are required to validate a system's performance. As it is well known, the S21-parameter set represents the transfer function of a high-speed communication channel, and signal integrity engineers typically strive to extract the channel impulse response by applying the inverse Fast Fourier Transform (IFFT) on the sampled S21 parameter data.

Extracting an accurate channel impulse response is of extreme importance in signal integrity since channel operating margins (COM) are getting tighter and tighter. The above IFFT process is applied without considering the sampled nature of the data, and in the wrong Laplace domain while striving to reach the always elusive frequency at infinite.

In this presentation, we briefly review S-parameter data and its relationship with steady state circuit analog circuit analysis. Then we use DSP techniques to show how to obtain an accurate channel impulse response by considering the sampled nature of the S-parameter data. Afterwards, we show how to use a bilinear transformation to position the S-parameter in the proper z-domain in order to obtain an accurate channel impulse response (without the use of complicated windowing operations and no need to search for frequency at infinity). This method is successfully used on several examples and compared with other existing methods.

This webinar will clearly show how many frequency points are needed in simulation or measurements to obtain enough information to accurately represent the impulse response from S-parameters. This information could help a signal integrity engineer to optimize measurement/simulation time, especially as data rates are getting higher and higher.

Presenter Bio:

Dr. Aldo Morales has been a faculty member at Penn State Harrisburg (PSH) since August 2001 and is currently a professor of the Electrical Engineering and Electrical Engineering Technology programs. He is a senior IEEE Member and IEEE 2015- 2016 Distinguished Lecturer (Regional), consumer electronic society.

His research interests are in signal integrity, mathematical morphology, digital image processing, computer vision, and neural networks. He co-founded the Center for Signal Integrity at Penn State Harrisburg.

Dr. Sedig S. Agili received his BS, MS, and Ph.D. in Electrical and Computer Engineering from Marquette University in 1986, 1989, and 1996, respectively. Upon receiving his Ph.D., he joined the faculty at Marquette University. In Fall of 2001, he joined the electrical engineering and electrical engineering technology programs at Penn State University, Harrisburg where he is currently a professor researching and teaching electronic communications, fiber optic communications, fiber optic sensors and signal integrity of high-speed interconnects. He co-founded the Center for Signal Integrity at Penn State Harrisburg.