Abstracts

Improving time-domain measurements with a network analyzer using a robust rational interpolation technique

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A method to efficiently and accurately compute a time-domain waveform from a network-analyzer frequency-domain measurement is presented in this paper. The method is based on a robust interpolation technique to construct a pole-residue representation of the response of the device-under-test. First, the rational function is expressed in terms of Chebyshev polynomials, instead of the usual power series, to accurately determine the poles of the network over a wide frequency range. The properties of a passive system are then utilized to efficiently calculate the residues. The resulting pole-residue model is analytically transformed to obtain the time-domain response in any time window, beyond the limitations of the discrete Fourier transform (DFT) technique. Unlike the DFT technique, the method does not require a large number of equally spaced harmonically related frequency points. The parametric model can also be used to economically store large measurement data. The proposed procedure is computationally inexpensive and less sensitive to numerical instability. To illustrate the validity of the method, examples of frequency- and time-domain measurements of a Beatty structure and simulation data of a low-pass Butterworth filter are given.

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