Time-Domain Network Analysis Bibliography

Donald C. DeGroot
October 19, 1998

Historical TDNA

- A. M. Nicolson, "Broad-band microwave Transmission characteristics from a single measurement of the transient response," *IEEE Transactions on Instrumentation and Measurement*, vol. 17, no. 4, pp. 395-402, December, 1968.
- A. M. Nicolson, C. L. Bennett, Jr., D. Lamensdorf, and L. Susman, "Applications of time-domain metrology to the automation of broad-band microwave measurements," *IEEE Transactions on Microwave Theory and Techniques*, vol. 20, no. 1, pp. 3-9, Jan., 1972.
- H. M. Cronson and P. G. Mitchell, "Time-domain measurements of microwave components," *IEEE Transactions on Instrumentation and Measurement*, vol. 22, no. 4, pp. 320-325, Dec., 1973.
- W. L. Gans and J. R. Andrews, "Time domain automatic network analyzer for measurement of RF and microwave components," National Bureau of Standards, NBS Technical Note 672, Sept. 1975.
- H. W. Loeb and P. J. Ward, "The use of time-domain techniques for microwave transistor *s*-parameter measurements," *IEEE Transactions on Instrumentation and Measurement*, vol. 26, no. 4, pp. 383-388, Dec., 1977.
- J. R. Andrews, "Automatic network measurements in the time domain," *Proceedings of the IEEE*, vol. 66, no. 4, pp. 414-423, Apr., 1978.
- N. S. Nahman, J. R. Andrews, W. L. Gans, M. E. Guillaume, R. A. Lawton, A. R. Ondrejka, and M. Young, "Applications of time-domain methods to microwave measurements," *IEE Proceedings*, vol. 127 H, no. 2, pp. 99-106, Apr., 1980.
- P. R. Rigg and J. E. Carroll, "Low-cost computer-based time-domain microwave network analyzer," *IEE Proceedings*, vol. 127 H, no. 2, pp. 107-111, Apr., 1980.
- G. Arjavalingham, Y. Pastol, J. M. Halbout, and G. V. Kopcsay, "Broad-band microwave measurements with transient radiation from optoelectronically pulsed antennas," *IEEE Transactions on Microwave Theory and Techniques*, vol. 38, no. 5, pp. 615-621, May, 1990.

Interconnection Characterization

- A. Deutsch, G. Arjavalingam, and G. V. Kopcsay, "Characterization of resistive transmission lines by short-pulse propagation," *IEEE Microwave and Guided Wave Letters*, vol. 2, no. 1, pp. 25-27, Jan., 1992.
- J. M. Jong and V. K. Tripathi, "Time-domain characterization of interconnect discontinuities in high-speed circuits," *IEEE Transactions on Components, Hybrids, and Manufacturing Technology*, vol. 15, no. 4, pp. 497-504, Aug., 1992.
- T. Dhaene, L. Martens, P. Degraeuwe, and D. De Zutter, "Improved time-domain characterization of high-speed interconnection structures," presented at Topical Meeting on Electrical Performance of Electronic Packaging, Tucson, Arizona, 1992.
- J. M. Jong, B. Janko, and V. Tripathi, "Equivalent circuit modeling of interconnects from time-domain measurements," *IEEE Transactions on Components, Hybrids, and Manufacturing Technology*, vol. 16, no. 1, pp. 119-126, Feb., 1993.
- P. Ferrari, G. Angénieux, and B. Fléchet, "Time domain characterization of lossy arbitrary characteristic impedance transmission lines," *IEEE Microwave and Guided Wave Letters*, vol. 4, no. 6, pp. 177-179, June, 1994.
- L. A. Hayden and V. K. Tripathi, "Characterization and modeling of multiple line interconnections from time domain measurements," *IEEE Transactions on Microwave Theory and Techniques*, vol. 42, no. 9, pp. 1737-1743, Sep., 1994.

- D. A. Smolyansky, S. K. Diamond, and V. K. Tripathi, “Accurate determination of the impedance profile using enhanced accuracy time domain reflection and transmission measurements,” presented at 44th ARFTG Conference, Boulder, CO, 1994.
- L. T. Hwang, G. A. Rinne, and I. Turlik, “An extended time-domain network analysis measurement technique,” *IEEE Transactions on Components, Packaging, and Manufacturing Technology*, vol. 18, no. 2, pp. 375-380, May, 1995.
- S. D. Corey and A. T. Yang, “Interconnect characterization using time-domain reflectometry,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 43, no. 9, pp. 2151-2156, Sep., 1995.
- R. B. Marks, D. C. DeGroot, and J. A. Jargon, “High-speed interconnection characterization using time domain network analysis,” *Advancing Microelectronics*, vol. 22, no. 6, pp. 35-39, Nov./Dec., 1995.
- J. M. Jong, B. Janko, and V. K. Tripathi, “Time-domain characterization and circuit modeling of a multilayer ceramic package,” *IEEE Transactions on Components, Packaging, and Manufacturing Technology—Part B*, vol. 19, no. 1, pp. 48-55, Feb., 1996.
- S. Sercu and L. Martens, “A new algorithm for experimental circuit modeling of interconnection structures based on causality,” *IEEE Transactions on Components, Packaging, and Manufacturing Technology—Part B*, vol. 19, no. 2, pp. 289-295, May, 1996.

Sampling Theory, FFTs, and Waveform Truncation Correction

- A. M. Nicolson, “Forming the fast Fourier transform of a step response in time-domain metrology,” *Electronics Letters*, vol. 9, no. 14, pp. 317-318, July 12, 1973.
- J. Waldmeyer, “Fast Fourier transform for step-like functions: The synthesis of three apparently different methods,” *IEEE Transactions on Instrumentation and Measurement*, vol. 29, no. 1, pp. 36-39, Mar., 1980.
- W. L. Gans and N. S. Nahman, “Continuous and discrete Fourier transforms of steplike waveforms,” *IEEE Transactions on Instrumentation and Measurement*, vol. 31, no. 2, pp. 97-101, June, 1982.
- A. M. Shaarawi and S. M. Riad, “Computing the complete FFT of a step-like waveform,” *IEEE Transactions on Instrumentation and Measurement*, vol. 35, no. 1, pp. 91-92, Mar., 1986.
- N. G. Paulter, Jr. and R. B. Stafford, “Reducing the effects of record truncation discontinuities in waveform reconstructions,” *IEEE Transactions on Instrumentation and Measurement*, vol. 42, no. 3, pp. 695-700, June, 1993.
- B. Widrow, I. Kollár, and M. C. Liu, “Statistical Theory of Quantization,” *IEEE Transactions on Instrumentation and Measurement*, vol. 45, no. 2, pp. 353-361, Apr., 1996.

Time Base Errors and Correction

- W. L. Gans, “The measurement and deconvolution of time jitter in equivalent-time waveform samplers,” *IEEE Transactions on Instrumentation and Measurement*, vol. 32, no. 1, pp. 126-133, March, 1983.
- T. M. Souders, D. R. Flach, C. Hagwood, and G. L. Yang, “The effects of timing jitter in sampling systems,” *IEEE Transactions on Instrumentation and Measurement*, vol. 39, no. 1, pp. 80-85, Feb., 1990.
- G. Tong and T. M. Souders, “Compensation of markov estimator errors in time-jittered sampling of nonmonotonic signals,” *IEEE Transactions on Instrumentation and Measurement*, vol. 42, no. 5, pp. 931-935, Oct., 1993.
- J. Verspecht, “Compensation of timing jitter-induced distortion of sampled waveforms,” *IEEE Transactions on Instrumentation and Measurement*, vol. 43, no. 5, pp. 726-732, Oct., 1994.
- L. Dobos, “Advancements in picosecond resolution time interval measurement techniques,” presented at Conference on Precision Electromagnetic Measurements, Boulder, Colo., 1994.

- J. B. Rettig and L. Dobos, “Picosecond time interval measurements,” *IEEE Transactions on Instrumentation and Measurement*, vol. 44, no. 2, pp. 284-287, Apr., 1995.
- J. P. Deyst, T. M. Souders, and O. M. Solomon, Jr., “Bounds on least-squares four-parameter sine-fit errors due to harmonic distortion and noise,” *IEEE Transactions on Instrumentation and Measurement*, vol. 44, no. 3, pp. 637-642, Jun., 1995.
- S. S. Awad, “The effects of accumulated timing jitter on some sine wave measurements,” *IEEE Transactions on Instrumentation and Measurement*, vol. 44, no. 5, pp. 945-951, Oct., 1995.
- J. P. Deyst and T. M. Souders, “Bounds on frequency response estimates derived from uncertain step response data,” *IEEE Transactions on Instrumentation and Measurement*, vol. 45, no. 2, pp. 378-383, Apr., 1996.
- J. Schoukens, R. Pintelon, and G. Vandersteen, “A sinewave fitting procedure for characterizing data acquisition channels in the presence of time base distortion and time jitter,” *IEEE Transactions on Instrumentation and Measurement*, vol. 46, no. 4, pp. 1005-1010, Aug., 1997.

Millimeter-Wave TDNA

- C. H. Lee, “Picosecond optics and microwave technology,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 38, no. 5, pp. 596-607, May, 1990.
- R. Y. Yu, M. Kamegawa, M. Case, M. Rodwell, and J. Franklin, “A 2.3-ps time-domain reflectometer for millimeter-wave network analysis,” *IEEE Microwave and Guided Wave Letters*, vol. 1, no. 11, pp. 334-336, Nov., 1991.
- R. Y. Yu, J. Pusl, Y. Konishi, M. Case, M. Kamegawa, and M. Rodwell, “A time-domain millimeter-wave network analyzer,” *IEEE Microwave and Guided Wave Letters*, vol. 2, no. 8, pp. 319-321, Aug., 1992.
- M. Y. Frankel, “500-GHz characterization of an optoelectronic s-parameter test structure,” *IEEE Microwave and Guided Wave Letters*, vol. 4, no. 4, pp. 118-120, Apr., 1994.
- Y. Konishi, M. Kamegawa, M. Case, R. Y. Yu, S. T. Allen, and M. J. W. Rodwell, “A broadband free-space millimeter-wave vector transmission measurement system,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 42, no. 7, pp. 1131-1139, Jul., 1994.
- M. J. W. Rodwell, R. Yu, M. Reddy, S. Allen, and U. Bhattacharya, “Active probes for on-wafer millimeter-wave network analysis,” presented at 1994 Conference on Precision Electromagnetic Measurements, Boulder, CO, 1994.
- R. Y. Yu, M. Reddy, J. Pusl, S. T. Allen, M. Case, and M. J. W. Rodwell, “Millimeter-wave on-wafer waveform and network measurements using active probes,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 43, no. 4, pp. 721-729, Apr., 1995.
- S. L. L. Huang, C. H. Lee, and H.-L. A. Hung, “Real-time linear time-domain network analysis using picosecond photoconductive mixer and samplers,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 43, no. 6, pp. 1281-1289, June, 1995.
- S. A. Shah, A. Zeng, W. S. Wong, M. K. Jackson, L. Pouliot, A. Lecours, and J. F. Currie, “Millimeter-wave time-resolved measurement near a discontinuity: Separating temporally overlapped incident and reflected signals,” *IEEE Microwave and Guided Wave Letters*, vol. 6, no. 2, pp. 79-81, Feb., 1996.

Calibrated TDNA

- W. R. Scott, Jr. and G. S. Smith, “Error corrections for an automated time-domain network analyzer,” *IEEE Transactions on Instrumentation and Measurement*, vol. 35, no. 3, pp. 300-303, Sept., 1986.
- P. Ferrari, G. Angénieux, and B. Fléchet, “A complete calibration procedure for the time domain network analyzers,” presented at IEEE MTT-S International Microwave Symposium, Albuquerque, NM, 1992.

- L. A. Hayden and V. K. Tripathi, “Calibration methods for time domain network analysis,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 41, no. 3, pp. 415-420, Mar., 1993.
- W. Su and S. M. Riad, “Calibration of time domain network analyzers,” *IEEE Transactions on Instrumentation and Measurement*, vol. 42, no. 2, pp. 157-161, Apr., 1993.
- T. Dhaene, L. Martens, and D. De Zutter, “Calibration and normalization of time domain network analyzer measurements,” *IEEE Transactions on Microwave Theory and Techniques*, vol. 42, no. 4, pp. 580-589, Apr., 1994.
- R. B. Marks, L. A. Hayden, J. A. Jargon, and F. Williams, “Time domain network analysis using the multiline TRL calibration,” presented at 44th ARFTG Conference, Boulder, CO, 1994.
- L. A. Hayden and R. B. Marks, “Accuracy in time domain transmission line measurements,” presented at 3rd IEEE Topical Meeting on Electrical Performance of Electronic Packaging, Monterey, CA, 1994.
- P. Boets and L. Van Bissen, “Non-parametric calibration of a time domain reflectometer,” presented at IMTC, Hamamatsu, 1994.
- D. C. DeGroot and R. B. Marks, “Optimizing time-domain network analysis,” presented at 46th ARFTG Conference, Scottsdale, AZ, 1995.
- D. DeGroot and J. Jargon, “Taking rf and microwave device measurements with a digital sampling oscilloscope,” *Instrumentation Newsletter*, vol. 9, no. 4, pp. T1-T2, Winter, 1997.

TDNA Measurement Uncertainty

- J. Verspecht, “Quantifying the maximum phase-distortion error introduced by signal samplers,” *IEEE Transactions on Instrumentation and Measurement*, vol. 46, no. 3, pp. 660-666, Jun., 1993.
- S. Diamond and S. Pepper, "Decode dynamic range in time/frequency-domain analyzers," *Microwaves and RF*, pp. 102-110, Sept., 1993.
- J. Verspecht, “Broadband sampling oscilloscope characterization with the "nose-to-nose: calibration procedure: A theoretical and practical analysis,” *IEEE Transactions on Instrumentation and Measurement*, vol. 44, no. 6, pp. 991-997, Dec., 1993.
- J. Verspecht and K. Rush, “Individual characterization of broadband sampling oscilloscopes with a nose-to-nose calibration procedure,” *IEEE Transactions on Instrumentation and Measurement*, vol. 43, no. 2, pp. 347-354, Apr., 1994.
- L. A. Hayden, R. B. Marks, and J. B. Rettig, “Accuracy and repeatability in time domain network analysis,” presented at 44th ARFTG Conference, Boulder, CO, 1994.
- M. Bertocco, C. Narduzzi, and D. Petri, “Optimized sinewave test of waveform digitizers by a DFT approach,” *IEEE Transactions on Instrumentation and Measurement*, vol. 46, no. 4, pp. 970-974, Aug., 1997.
- G. Vandersteen, Y. Rolain, and J. Schoukens, “System identification for data acquisition characterization,” presented at IEEE Instrumentation and Measurement Technology Conference, St. Paul, Minn., 1998.
- D. C. DeGroot and J. A. Jargon, “Long term stability in a calibrated time-domain network analyzer,” *Proc.1998 Measurement Science Conference*, , Feb. 5-6, 1998.