Liquid Level Detection Using Time Domain Reflectrometry Techniques

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ABSTRACT

For Time Domain Reflectometry (TDR), applying in the discontinuity of transmission line, it is a method for detecting the reflected amplitude and delayed time by using time-domain reflective measurement and analysis for calculating both the characteristic impedance variation and physical locations of discontinuities. Time Domain Reflectometry included TDR impulse generator and liquid level detection technique are presented in the thesis. For TDR impulse generator, the narrow pulse with ns duration can be obtained by using Schmitt-trigger and Schmitt-inverter. For practice, the TDR impulse generator is applied for liquid level diction. The liquid level detection can be achieved in this work by the developed 3ns TDR impulse generator. Key Words : Time Domain Reflectometry (TDR), Schmitt trigger

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REFERENCES

[1] ASTM, D6565-00 (2000). Standard Test Method for Determination of Water(Moisture) Content of Soil by the Time-Domain Reflectometry (TDR)method, Annual Book of ASTM Standards, Vol. 04.08, pp. 1118-1122.
[2] Christopher P.Nemarich,“ Time Domain Refletometry Liquid Level Sensors,” IEEE 1094-6969/01,Dec.2001.
[3] Time Domain Reflectometry Theory，HP Application Note 1304-2, 1998.
[4] 林志平，周家榮，2001，“時域反射儀在大地工程量測之應用”，地工技術，第83 期，民國九十年二月，5-12 [5] Time-Domain Reflectomter，Tektronix 1502C / 070-7169-02，Nov 1997.
[6] 葉致翔，TDR邊坡資訊自動化監測系統，碩士論文，國立交通大學土木工程學系，2003.
[7] 廖偉捷，時域反射與小波轉換應用於線束故障偵測之研究，碩士論文，中原 大學電機工程學系，2004.
[8] UMRAN S. INAN and AZIZ S.INAN,“ ENGINEERING Electromagnetics,” 歐亞書局.
[9] H.W. Johnson, M.Graham,“ High-Speed Digital Design, A Handbook of Black Magic” Prentice Hall, 1993.
[10] H.B. Bakoglu, Circuits, Interconnections, and Packaging for VLSI, Addison Wesley Publishing Company, USA, 1990.
[11] S. Navaneethan, J. J. Soraghan, W. H. Siew, R. Muirhead, and J. Livie,“ AnAutomatic Fault Detection and Location Technique in Low Voltage Distribution Networks”, IEEE 98EX137, 0-7803-4495-2/98, page 732~736, 1998 .
[12] 何文博，時域最小平方法萃取等效電路模型之研究，碩士論文，國立中山大學電機工程學系，2000.
[13]“ Agilent Technologies 8719D/20D/22D Network Analyzers,” Agilent Technologies Service Guide, 08720-90292, June1998.
[14] J. Detlefsen,“ Frequency response of input impedance implies the distribution of discontinuities of a transmission line system,” Electron Lett., vol. 6, pp. 67 – 69, Feb. 1970.
[15] Ching-Wen Hsue, and Te-Wen Pan,“ Reconstruction of Nonuniform Transmission Lines from Time-Domain Reflectometry,” IEEE Trans. Microwave Theoly Tech, vol. 45, NO. 1, Jan. 1997.
[16] Topp, G.C., Davis, J.L., and Annan, A.P. (1980).“ Electromagnetic Determination of Soil water Content: Measurement in Coaxial Transmission Lines.” Water Resources Research, Vol. 16, pp. 574-582.
[17] Whalley, W.R. (1993).“ Considerations on the Use of Time Domain Reflectometry (TDR) for Measuring Soil Water Content.” Soil ScienceSociety of America Journal, Vol. 44, pp. 1-9.
[18] Topp, G.C., Yanyka, M., Zebchuk, W.D., and Zegelin, S.(1988).“ Determination of Electrical Conductivity Using Time Domain Reflectometry: Soil and Water Experiments in Coaxial Line.” WaterResources Research, Vol. 24, No. 7, pp. 945-952.
[19] Selker, J.S., L. Graff, and T. Steenhuis. 1993. Noninvasive time domain reflectometry moisture measurement probe. Soil Sci. Soc. Am. J. 57:934 – 936 [20] R. Pintelon and L. Van Biesen,“ Identification of transfer functions with time delay and its application to cable fault location,” IEEE Transactions Instrumentation Measurement Vol.39, pp.479-484,June 1990.
[21] David M. Pozar,“ Microwave engineering,” 2nd ed., John Wiley & Sons,Inc,1998 [22] Texas Instruments,“ SN54ACT14,SN74ACT14 HEX SCHMITT -TRIGGER INVERTER ”, SCAS557H ,DECEMBER , 1995 , REVISED NOVEMBER 2004.
[23] 何中庸，振盪電路之設計與應用，全華科技圖書，pp.1-2,pp.1-5,1999.

[24] Donghwan Lee, Jinho Sung and Jaehong Park, “ A 16ps -Resolution Random Equivalent Sampling Circuit for TDR Utilizing a Vernier Time Delay Generation ”, IEEE 0- 7803-8257-9/04, page 1219~1223,2004.
[25] K. O. Park and J. H. Park, “ 20ps resolution time-to-digital converter for digital storage oscilloscopes, ” in Proc. IEEE NSS-MIC, Toronto, Canada, Nov. 1998 [26] S. Guo, S. Sun and Z. Zhang, “ A novel equivalent sampling method using in the digital storage oscilloscopes, ” in Proc. IEEE IMTC, vol.2, pp. 530-532, 1994.