

INTERFACING ELECTRONIC FOR MEASUREMENT,  
SIGNAL PROCESSING AND WIRELESS  
COMMUNICATION



Edited by

Sheroz Khan, International Islamic University Malaysia

AHM Zahirul Alam, International Islamic University Malaysia

Anis Nurashikin Nordin, International Islamic University Malaysia



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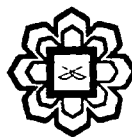
# **INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION**

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## Chapter 29

# UWB PULSE GENERATION AND SHAPING: ANALYSIS AND SIMULATION RESULTS

ZEESHAN SHAHID, SHEROZ KHAN, AHM ZAHIRUL ALAM

### 29.1. INTRODUCTION

Short pulses generation has application in many areas, such as: i) Linear system characterization; ii) Time Domain reflectometry (TDR); and iii) Ultra Wide Band systems (Remley & Williams, 2003). The linear system characterization and calibration relies substantially on the determination of their pulse response. Instrument performance and its compensation for non-linear behavior of the system can be made by knowing the pulse response of the instrument, e.g. the digital oscilloscope pulse response can be used to determine and characterize its short pulse response (Remley & Williams, 2003).

### 29.2. APPLICATIONS

In TDR systems the short pulse generators are used to characterize long distance transmission lines and to detect open (or short) circuit faults existing over the lines. By analyzing pulse reflections, one can use this reflectometry for estimation of signal parameters such as change in impedance, length of the line, time delay caused and pulse dispersion with high accuracy (Abessolo, Poirier, Descamps & Domenges, 2005). Another application area for short-pulse generation is UWB systems, where sub-nanosecond pulse generation is of interest by researchers. In the case of UWB pulses used for response evaluation, the information provided is in more detail as the resulting frequency components' responses are extensive and more elaborative. Federal Communications Commission (FCC) while discussing rules for communication in its report defines a UWB system as an unlicensed frequency spectrum ranging over 7, 500 MHz spreading over frequency band ranging from 3.1GHz to 10.6GHz (Ferrari, Marioli & Taroni, 2000). The origin of UWB technology dates back to the early 1960s from its application view point in electromagnetic. After several years of technological advancement, UWB systems have been used in several applications already elaborated in (Fontana, 2004). These applications consist of: the following:

Radar systems with high-range measurement accuracy and resolution High-data rate for short-range communication systems Sensor networks for indoor communication and positional location Ground-penetrating radars.