

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



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

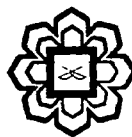
# **INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION**

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**IIUM Press**

Published by:  
IIUM Press  
International Islamic University Malaysia

First Edition, 2011  
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Sheroz Khan, AHM Zahirul Alam & Anis Nurashikin Nordin: Interfacing Electronic for Measurement, Signal Processing and Wireless Communication.

ISBN: 978-967-418-171-0

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM  
(Malaysian Scholarly Publishing Council)

Printed By:  
**IIUM PRINTING SDN.BHD.**  
No. 1, Jalan Industri Batu Caves 1/3  
Taman Perindustrian Batu Caves  
Batu Caves Centre Point  
68100 Batu Caves  
Selangor Darul Ehsan  
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543  
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## Chapter 23

# UWB COMMUNICATION FOR BIOMEDICAL IMPLANTS

MOKHALED M., MOHAMMED, SHEROZ KHAN, JALEL CHEBIL, KHALED A. S. AL-KHATEEB, IMRAN MOEZ KHAN

Modulation is the process of changing a certain attribute (Amplitude, Phase, Frequency, etc...) of a signal to represent information to be transmitted. As with conventional communications, UWB communication system requires modulation to carry the information. In this chapter, we take an overlook over the concept of modulation, UWB modulation, highlighting the main techniques in UWB modulations and their applications.

### 23.1. MODULATION

As described above, the process of modulation is the operation of changing certain attribute of a carrier signal (or modulated signal ,a signal that would carry the information through the communications medium) with the baseband or information signal (modulator signal, a signal that represents information). The process of modulation in conventional narrow band communications happens through the multiplication of these two signals. The process of modulation employs the characteristics of the convolution process to multiply the signals. Convolution (folding together) of two signals is the process of integrating, adding, multiplying, and time shifting of two functions together. This is mathematically represented by:

$$(a * b)(t) = \int_{-\infty}^{\infty} a(\tau)b(t - \tau)d\tau \quad (1)$$

The most important characteristic of convolution that is very vital to communication systems is that the Fourier transform of convolution which is the point-wise product of the two functions. In other words, the convolution of two signals in one domain is equal to the point-wise multiplication in the other domain. This is given by:

$$F\{f * g\} = F\{f\} \cdot F\{g\} \quad (2)$$

Therefore, by multiplying the two signals in the time domain, the signals are convolved in the frequency domain. There are two main categories of modulation systems, namely: analog modulation and digital modulation. In digital modulation, the analog or continuous signal is modulated after discrete samples are taken in the process of analog to digital conversion. The discrete samples are taken in time in the process of sampling, and discrete values are taken for the amplitude of the signal in the process of quantization. Then the resulting digital signal is modulated, by the modulating signal, for transmission (Sudakshina, 2010).