**An Ultra-wideband (UWB) Approach to Early Stage Breast Cancer Detection**

*by*

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Abstract

Breast cancer is a major global health problem and the leading cause of death among women of all ethnic backgrounds. Each year, an estimated of 1.6 million cases are diagnosed worldwide. It is reported that one in eight women in Europe and United States are at risk of developing breast cancer in comparison to one in nineteen women in Malaysia. Nevertheless breast cancer is a treatable disease when the detection is done earlier, especially during Stage 1 of its development in which the tumour is 20 mm or smaller in size at its widest area. Unfortunately such an early stage of detection is still very challenging, and breast cancer remains the only type of cancer with a positive growth rate over the last decades. Currently x-ray mammography remains a golden standard for breast cancer patients. Although this technique is widely used in major hospitals, however, mammography is seldom recommended for women aged below 40 years because of the small contrast between healthy and cancerous cells leading to high false positive and negative rates. Moreover there is health risk associated with x-ray due to its ionising characteristics in which the radiations are accumulated over repeated scans. Other methods including the magnetic resonance imaging (MRI) and ultrasound probing are too expensive for mass screening purposes. For these reasons the microwave imaging approach has emerged as an attractive technique for early discovery of breast cancer tumour. This attraction is motivated by the high dielectric property contrast between normal and malignant tissues at microwave frequencies. Resultantly this topic has been the subject of intense research in the past two decades, resulting in the development of novel sensors, new instrumentation, and improved image reconstruction software. In spite of this development, one fundamental weakness which is plaguing almost all microwave systems is the resolution. In this case good spatial resolution demands a small wavelength and therefore high frequency. Higher frequencies, in the other hand, are attenuated more rapidly, and the adequate depth of penetration dictates a low frequency, no higher than 5 MHz. The advent of ultra-wideband (UWB) technology stimulated new interest in this field, further motivating its potential for breast cancer detection. This keynote addresses the development of UWB research at USM, focussing on the development small and minuturised antenna together with an improved beam forming techniques with the state-of-the-art methods for side lobes suppression.