

Early Detection of Breast Cancer Using Patch Antenna

¹G.P.GaneshVarma,²Vuppalapati Manohar,³ C.Bala Krishnan,⁴ Mr.S.Ashok

^{1,2,3}U.G Students, ⁴Assistant professor

Department of Electronics and Communication Engineering

VEL TECH MULTI TECH DR.RANGARAJAN DR.SAKUNTHALA ENGINEERING COLLEGE

Abstract – Breast tumor is one of the most life-threatening diseases and hence its detection should be fast and accurate. The medical imaging techniques such magnetic resonance imaging (MRI), computed tomography (CT), microwaves are used to detect tumour. However, due to gray scale noise tumour region in image are not properly visible. In the present world communication system using wireless technology is improving day by day and many researches are undergoing. The study of communication systems is incomplete without understanding the operations and concepts used in antennas. Of these, there are several techniques that have been used to feed micro strip patch antennas. Edge feeding and Inset feeding techniques are used. The functional characteristics and the output parameters like VSWR, Return loss, Radiation pattern of patch antenna varies with the technique

used. Comparison of above parameters has been made on the basis of feeding on micro strip patch antennas with their simulated performance characteristics. Both feeding models have been designed and simulated in Advanced Design System (ADS) which is an electronic design automation software system. Now a day's breast tumour is one of the most life threatening diseases and its detection should be fast and accurate. Here we propose a antenna based approach to detect tumour cell less than 5mm.

KEYWORDS: Microstrip patch antenna, feeding, single frequency, breast cancer, tumour cell.

1. INTRODUCTION

In the recent survey it is found that in United States most of the women deaths occur

due to breast cancer and is the second principal cause of cancer deaths in every eight American women will yield to breast cancer before the age of 70. Here we use microstrip patch antenna for tumour detection. Patch antenna is a type of radio antenna which can be mounted on flat surface. It consists of flat rectangular sheet or patch of metal, mounted over a large sheet of metal called ground plane. The most commonly used employed microstrip antenna is rectangular patch antenna. As the dielectric constant of substrate increases, antenna bandwidth decreases which increases the directivity of the antenna and therefore decreases the impedance bandwidth. This antenna emits minimal radiation compared to other systems.

In previous studies, non-invasive microwave hyperthermia for breast cancer is presented. It includes three dimensional breast models and antenna arrays. Here the frequencies around 4.2GHz and 4.5GHz are used for hyperthermia treatment. The goal is to elevate the temperature to above 42°C at the tumour location while maintaining normal temperature in other areas. In this model hotspots are produced. [1]

The limitations from previous model were overcome in this model. As in this multi-frequency applicators can be exploited to reduce occurrence of undesired hotspots and the procedure can be extended both to the case of vector field and the problem of shaping with the scalar fields. [2]

A new time reversal (TR) based ultra wide band (UWB) microwave method for breast cancer treatment is presented. Time reversal (TR) and Robust Capon Beam former (RCB) are employed to shape the transmitted signals and this method has better electromagnetic focussing ability than existing methods. [3]

In another study it provides a computational study concerning a new focussing technique for breast cancer treatment with the use of recent method for synthesis of pencil beams by means of fixed geometry arrays and it is tested against 2-D realistic breasts phantoms. [4]

A Novel focusing technique in non invasive microwave thermotherapy for breast cancer is given. It mainly focuses on application of micro strip structure in this systems is based on the near field characteristics of micro strip antenna, thus to improve the energy density of the target area. This device will achieve near field focusing effect by using single antenna instead of antenna array.[5]

A Computational study comparing the performance of narrowband (NB) microwave hyperthermia for breast cancer treatment with ultra wide band approach Performance is evaluated using finite difference time domain electromagnetic and thermal simulations with realistic numerical breast phantoms derived from magnetic resonance images of breast

model. It offers ultra wide focusing, offers the potential for tighter focusing and it reduces hotspot too particularly in breast issues.[6]

2. INFERENCE FROM LITERATURE SURVEY

In one of the existing system it uses thermal and microwave constrained focusing, the tumour is exposed to high temperature. It leads to formation of hotspots on the breast area .Here it emits high frequency of 4.5GHz and radiation. Here three dimensional antennas are used. In our proposed model, we do not emit any thermal energy and the tumour is not burnt here. So there is no possibility for the formation of hotspots and single microstrip patch antenna is used

In multi frequency constrained SAR focusing applicators can be exploited to reduce occurrence of unwanted hotspots. In this multi frequency approach is proposed whereas, in our proposed model we use single frequency.

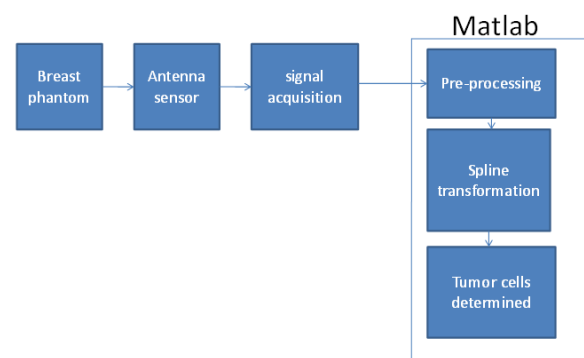
In another model electromagnetic focusing on patient specific breast models is implemented to concentrate the power at tumour position while keeping the power levels at other positions at minimum values while in proposed model we do not emit any radiation which harms the human body, even

frequency is very less compared to other models

In the study of Ultra Wide band versus narrow band microwave model, it detects tumour only if the tumour is greater than or equal to 10mm where as in our model we detect tumour size of 5mm.

3. METHODOLOGY

Block diagram

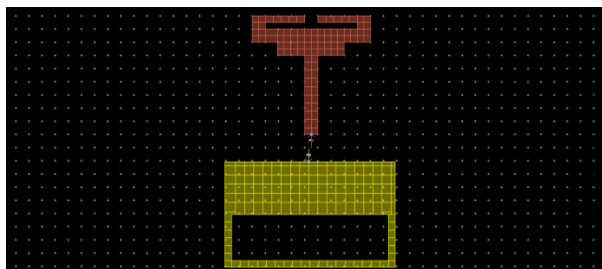
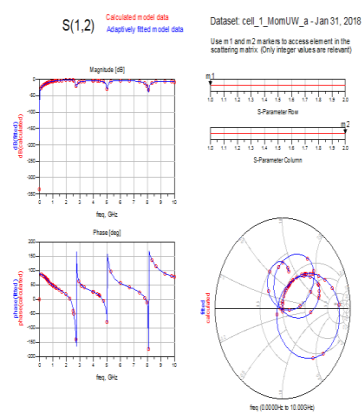


BREAST PHANTOM

It is a clone of practical breasts which is made up of mica or silicone gel where tumour is placed inside it .Here the tumour size is of 5mm which can be detected in early stages of cancer.

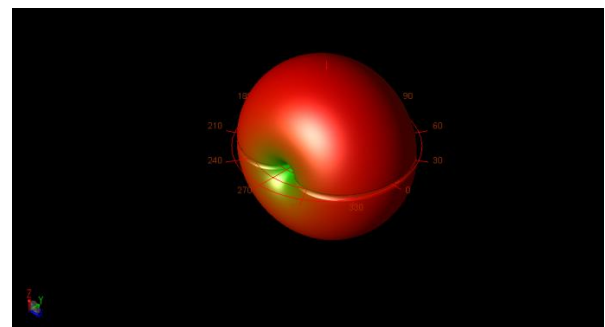
ANTENNA SENSOR

Here micro strip patch antenna is used as antenna sensor. The antenna is designed using advanced designing system (ADS). The substrate used is FR4. The gain of the patch antenna is -54.5502 dbi and its directivity is 1.8277 dbi, power radiated is 1.9913×10^{-11} watts, effective value 8.24973. The material used for antenna is copper.



The above figure shows phase and magnitude of an antenna where in phase it works efficiently in the frequencies of 2.8, 5, 8.1 Hz.

Antenna dimensions are 2.8 x 3.3 and the ground plane dimensions are 43 x 54.



Radiation pattern for designed patch is shown above.

CLASS- D AMPLIFIER

When a signal is amplified, the magnitude of the signal is increased totally. Converting the 0 -10 mV signals to an 0 -10V signal is an example of amplification. Class d amplifier is an electronic device where the amplifying devices such as transistors operate as electronic switches.

SIGNAL ACQUISITION

The signal from the antenna sensor is received by data acquisition chamber where signal is received and sends the signal to MATLAB for further processing where different signals are generated.

MATLAB

In MATLAB , first we have done filtering using Butterworth filter. In second phase spline transformation is done to avoid noise. In third phase we compared cancer signals with normal signals by the difference between the two we could the presence of tumour.

SIGNAL CONDITIONER

It is a device that converts on type of electronic signal into another type of signal. Its primary use is to convert a signal that may be difficult to read by conventional instrumentation into a more easily read format. Analog signal conditioners are designed to

isolate, transmit, convert, split and amplify analog signals.

PRE PROCESSING

It is the initial stage of the MATLAB process. Pre processing is the phase where the unwanted noises present in the signal are removed and send the processed signal for further transformation.

SPLINE TRANSFORMATION

In mathematical subfields of numerical analysis basis spline or b-spline, is a spline function that has minimal support with respect to given degree, Smoothness and domain partition, b-spline function is a combination of flexible bands that passes through the number of points called control points and creates smooth curves. Here it analyse the waveform and if it detects any odds it again goes through the particular odd location and the analyse the particular area in the waveform with respect to degree, smoothness and domain partition of the waveform

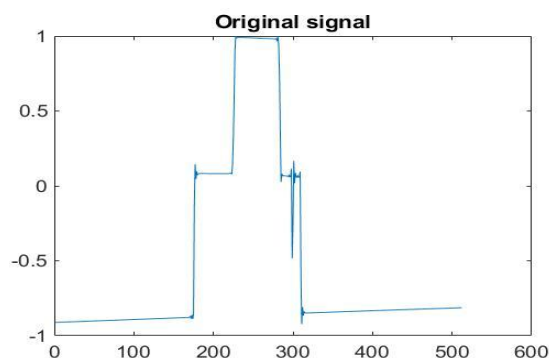
DETERMINATION OF TUMOUR CELLS

It is the final stage of the MATLAB process. In this block tumour cells are detected by using output obtained from the MATLAB, size and shape of the tumour cell is determined.

4. RESULTS AND DISCUSSION

The aspire of this paper is to identify the tumour from the breast models. As the part of process initially a breast phantom is taken which is made up of mica and tumour made up of epithelial cells is inserted inside the phantom

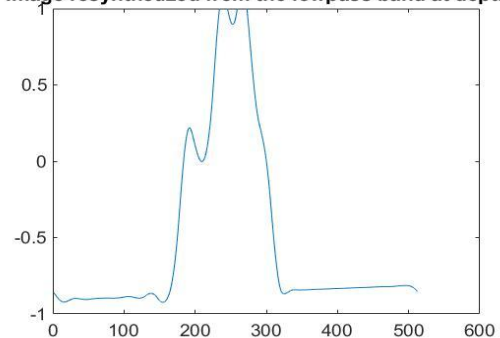
Here basically every human body emits certain amount of energy, now in our model we use microstrip patch antenna for absorbing such radiation. The radiations absorbed by antenna are given to the data acquisition ie, here we use class d amplifier then we record the signals of phantom with tumour and without tumour individually using sigview software. The recorded signals are then send to MATLAB for tumour detection. in initial stage of MATLAB pre-processing is done



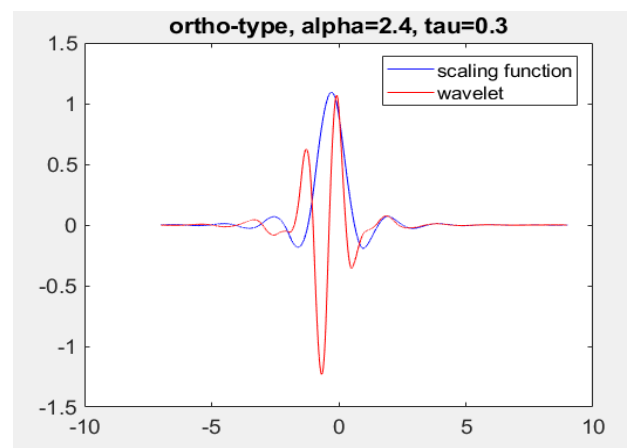
(a) Original image of signal

Then the signal is resynthesized and the signal is shown below

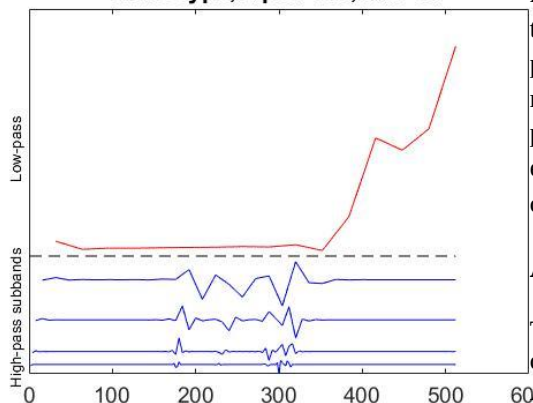
Image resynthesized from the lowpass band at depth 4



Then the resynthesized image is send to spline transformation where smoothness is added to the signal.



**Fractional Spline Wavelet Transform (4 levels)
ortho-type, $\alpha=2.4$, $\tau=0.3$**



After the elimination of noise and odds from the signal the tumour cell is determined in sub band as shown in above figure.

5. CONCLUSION

In the real time system antenna based approach is used to validate for breast cancer treatment. Hence we propose a new antenna design with particular frequency to detect cancer cells less than 5mm. The antenna emits minimal radiation compared to conventional systems. The frequency range of the antenna is 2.8 GHz which is minimum when compared with the other models. It is biocompatible as it does not emit radiation for the formation of hotspots on body. Breast is a shapeless organ the shape and position of breast during treatment might be different from that acquired by MRI, which is used to construct the breast model. The toughness of

the proposed approach against errors of modelling is a vital future step in confirming the feasibility of the presented method. The proposed method is simpler compared to other models and Earlier diagnosis of cancer enables physicians to treat cancer cell with tablets and eliminate the need for surgery and chemotherapy.

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