

Breast Cancer Sensing and Imaging Utilized Printed Ultra Wide Band Spherical Sensor Array

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Abstract : High precision of printed microwave sensor utilized for sensing and monitoring the potential breast cancer existed in women breast tissue was optimally computed. The single element of UWB printed sensor that successfully modeled through several numerical optimizations was multiple fabricated and incorporated with woman bra to form the spherical sensors array. One sample of UWB microwave sensor obtained through the numerical computation and optimization was chosen to be fabricated. In overall, the spherical sensors array consists of twelve stair patch structures, and each element was individually measured to characterize its electrical properties, especially the return loss parameter. The comparison of S11 profiles of all UWB sensor elements is discussed. The constructed UWB sensor is well verified using HFSS programming, CST programming, and experimental measurement. Numerically, both HFSS and CST confirmed the potential operation bandwidth of UWB sensor is more or less 4.5 GHz. However, the measured bandwidth provided is about 1.2 GHz due to the technical difficulties existed during the manufacturing step. The configuration of UWB microwave sensing and monitoring system implemented consists of 12 element UWB printed sensors, vector network analyzer (VNA) to perform as the transceiver and signal processing part, the PC Desktop/Laptop acting as the image processing and displaying unit. In practice, all the reflected power collected from whole surface of artificial breast model are grouped into several numbers of pixel color classes positioned on the corresponding row and column (pixel number). The total number of power pixels applied in 2D-imaging process was specified to 100 pixels (or the power distribution pixels dimension 10x10). This was determined by considering the total area of breast phantom of average Asian women breast size and synchronizing with the single UWB sensor physical dimension. The interesting microwave imaging results were plotted and together with some technical problems arisen on developing the breast sensing and monitoring system are examined in the paper.

Keywords : UWB sensor, UWB microwave imaging, spherical array, breast cancer monitoring, 2D-medical imaging

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020