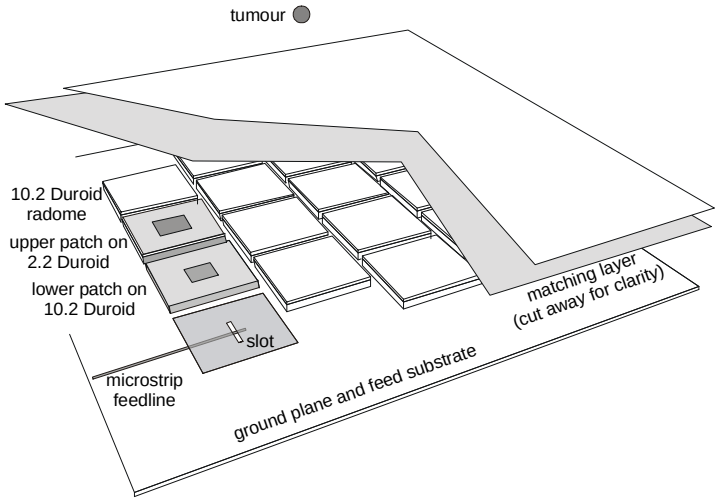
Microwave Detection of Breast Tumours

R.Nilavalan[1], I.J.Craddock[2], A. Preece[1], J.Leendertz[1] and R.Benjamin[3]

1 *Department of Medical Physics, University of Bristol, UK*
2 *Department of Electrical & Electronic Engineering, University of Bristol, UK*
3 *13 Bellhouse Walk, Bristol, BS11 OUE, UK*

Breast cancer is the most common cancer in women. World-wide in 2003, it is estimated that a woman will be diagnosed with breast cancer every 3 minutes and a woman will die from the disease every 13 minutes. X-ray mammography is currently the most effective technique [1], however it suffers from a relatively high missed- and false-detection rates and involves uncomfortable compression of the breast. X-rays are also ionising and therefore not generally suited to frequent screening.

Microwave detection of breast tumours is a non-ionising, potentially low-cost and potentially more certain alternative. The work presented here employs a post reception synthetically focussed detection method developed for land mine detection [2]; all elements of an antenna array transmit a broadband signal in turn, the elements sharing a field of view with the current transmit element then record the received signal. By predicting the path delay between the transmit and receive antennas via any desired point in the breast, it is then possible to extract and time-align all the signals from that point. Repeated for all points in the breast, this yields an image in which the distinct dielectric properties of malignant tissue are potentially visible.



This contribution presents theoretical (using FDTD) and practical results (using a phantom) from a stacked-patch antenna array.

The FDTD model, shown left, includes the array, and realistic representations of the skin, healthy breast tissue and the tumour.

The practical results were gathered using a VNA and a tissue/tumour phantom.

The results to be presented from these initial theoretical and practical investigations show considerable promise and will assist in the development of a complete system.

References

[1] M.Brown, F.Houn, E.Sickles and L.Kessler, Screening Mammography in Community Practice, Amer. J. Roentgen, Vol. 165, pp 1373-1377, Dec 1995.

[2] R.Benjamin, I.J.Craddock, G.S.Hilton, S.Litobarski, E.McCutcheon, R.Nilavalan, G.N.Crisp, Microwave detection of buried mines using non-contact, synthetic near-field focusing. IEE Proceedings: Radar, Sonar & Navigation, vol.148, no.4, Aug. 2001, pp.233-40. Publisher: IEE, UK.