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FACUTLY OF ENGINEERING
ELECTRICAL ENGINEERING DEPARTMENT

MICROWAVE BREAST TUMOR TREATMENT

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Eng. Heba Abd Elhamid Hassan Elkayal

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ABSTRACT

Hyperthermia is potentially an effective method for the treatment of cancer, especially breast cancer tumors. One of the most attractive attributes of hyperthermia is the possibility of providing therapeutic benefit noninvasively, minimizing side effects. To be effective, a hyperthermia treatment must selectively heat the cancerous tissue, elevating the temperature in the tumor without exposing healthy tissue to excessive temperature elevations.

The heating method for therapeutic hyperthermia uses ultrasound or microwaves. Ultrasound needs a lot number of transducers to produce the required heating energy. Also, ultrasound is often unsuitable due to strong scattering by air and bone. Microwave heating overcomes this problem, and hyperthermia for deep tumors can be achieved by using an array of radiative applicators placed in a circumferential array about patient, relying on constructive wave interference to selectively heat tumors. Such type of array is called the annular phased array.

The annular phased array has emerged as a popular alternative for the treatment of deep-seated tumor sites. For radiation from that array to be focused at the tumor site without the formation of auxiliary foci ("hot-spots"), the driving phases and amplitudes of the array must be chosen carefully. A major challenge faced by users of the annular phased array has been to determine the magnitudes and phases of powers that are needed for the various antenna elements to obtain highest rates of energy deposition (specific absorption rates) in the tumor volume with negligible values in the surrounding normal tissues.

In this thesis, a suggested simple model of APA using eight half wavelength linear dipoles is presented. New software (COMSOL MULTIPHYSICS) is used to calculate the temperature distribution inside a model of a three layered breast (skin, breast tissue, and tumor). In addition, the effect of changing the amplitude and phases of the array elements on the temperature distributions and the conditions on the values of the phases are demonstrated in order to achieve the objective of hyperthermia for breast tumor treatment.