Special Talk 2

Satish Udpa

Executive Vice President and University Distinguished Professor of
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Title of the special talk:

Microwave Based Systems for Imaging Tissue

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Abstract of the special talk:

The talk will present a novel system which employs an alternate approach to imaging tissues. Conventional tomographic reconstruction systems (catscan) have traditionally employed x-rays to obtain 3D images of tissues. The use of x-rays assures excellent resolution and penetration characteristics. The disadvantages of using x-rays include the ionizing nature of the radiation employed for imaging as well the relatively low contrast obtained between healthy and cancerous tissue. A number of studies carried over the past several years have shown that the significant differences in the electrical properties associated with certain types of malignant tumors and normal tissue can be exploited as a basis for imaging tissue. The differences in electrical properties can also be utilized to selectively focus microwaves on the malignant tissue to raise its temperature as part of a hyperthermia treatment protocol, or possibly even to induce necrosis of the tissue. Most tomographic reconstruction systems also involve measurement of a series of projections obtained by rotating a source-detector pair around the patient. This requires the patient to be confined inside a tube during the

scanning process. Confinement within a tube can sometimes be a challenge when the patient is too young or is claustrophobic. This talk will present a novel system which avoids the use of the traditional rotational scanning scheme and utilizes, instead, a set of electronically programmable mirrors to deflect microwaves. Microwaves deflected by the mirrors and scattered by the tissue are measured and processed to obtain a 3D image reconstruction of the tissue. The same system can be employed to as a therapy tool where the mirrors can be programmed to focus microwaves on the cancerous tissue to elevate it temperature. The talk will describe the system integration issues associated with a prototype system that is being built to validate the concept.

Biography:

Satish Udpa serves Michigan State University as the Executive Vice President for Administrative Services and University Distinguished Professor. He served as the Dean of the College of Engineering and Chair of the Electrical and Computer Engineering Department at MSU before his current appointment. Prior to joining MSU in 2001, Dr. Udpa was the Whitney Professor of Electrical and Computer Engineering at Iowa State University. He was on the faculty at Colorado State University prior to his stint at Iowa State University. Udpa's research interests span the broad area of materials characterization and nondestructive evaluation (NDE). Work done by him to date in the area includes an extensive repertoire of forward models for simulating physical processes underlying several inspection techniques. He has also been involved in the development of system-based and model-based inverse solutions for defect and material property characterization. His interests have expanded in recent years to include the development of noninvasive tools for clinical applications, such as new electromagnetic-acoustic (EMAT) methods for detecting single-leg separation failures in artificial heart valves as well as microwave imaging and ablation therapy systems. He has published extensively, holds several patents, and is the technical editor of the Electromagnetic Nondestructive Testing Handbook published by the American Society for Nondestructive Testing. He serves as the editor of the IEEE Transactions on Magnetics and is the regional editor of the International Journal of Applied Electromagnetics and Mechanics. Dr. Udpa is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), the American Society for Nondestructive Testing, the Indian Society for Nondestructive Testing and the Engineering Society of Detroit. He is a Full member of the Academia NDT International. Dr. Udpa also served as the permanent secretary of the World Federation of NDE Centers from 1998 to 2003.