Abstracts

Near-field microwave imaging of biologically-based materials using a monopole transceiver system

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A prototype monopole-transceiver microwave imaging system has been implemented, and initial single and multitarget imaging experiments involving biologically relevant property distributions have been conducted to evaluate its performance relative to a previously developed-waveguide system. A new, simplified, but more effective calibration procedure has also been devised and tested. Results show that the calibration procedure leads to improvements which are independent of the type of radiator used. Specifically, data-model match is found to increase by 0.4 dB in magnitude and 4/spl deg/ in phase for the monopoles and by 0.6 dB in magnitude and 7/spl deg/ in phase for the waveguides (on average) on a per measurement basis when the new calibration procedure is employed. Enhancements are also found in the reconstructed images obtained with the monopole system relative to waveguides. Improvements are observed in: 1) the recovered object shape; 2) the uniformity of the background; 3) edge detection; and 4) target property value recovery. Analyses of reconstructed images also suggest that there is a systematic decrease of approximately 10% in the reconstruction errors for the monopole system over its waveguide counterpart in single-target experiments and as much as a 20% decrease in multitarget cases. Results indicate that these enhancements stem from a better data-model match for the monopoles relative to waveguides which is consistent across the type of calibration procedure used. Comparisons of computations and measurements show an average improvement in data-model match of approximately 0.25 dB in magnitude and near 7/spl deg/ in phase in favor of the monopoles in this regard. Beyond this apparent imaging performance enhancement, the monopole system offers economy-of-space and low construction-cost considerations along with computational advantages (as described herein) which make it a compelling choice as a radiator/receiver element around which to construct a clinically viable near-field microwave imaging system.

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