

Shape Reconstruction of Two-Dimensional Targets Using TE-TM Hybrid Linear Sampling Method

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Linear sampling method (LSM) is a simple and effective method for reconstruction of unknown objects shape. It is also a fast and reliable method for finding the location of an object. This method is based on far field operator which relates the far field radiation to its associated line source in the object. There has been an extensive research on different aspects of the method. However from the experimental point of view there has been little research especially on the effect of polarization on the imaging quality of the method. In the early stages of our research we have studied the effect of transverse electric (TE) and transverse magnetic (TM) polarizations on the quality of shape reconstruction in penetrable and impenetrable two dimensional targets. Numerical simulations show that the quality of reconstruction in perfect electric conductor objects is better than dielectric for TM polarization. However, in the dielectric object, TE polarization operates better than TM. Also it was observed that the speed of reconstruction for PEC objects is higher than dielectric which returns to the nature of EFIE and creating mesh in MOM.

The essential idea in this paper is to focus on the polarization in two dimensional LSM for image reconstruction of penetrable and impenetrable targets. Due to orthogonally of the TE and TM polarizations, each of them contains information regarding the target which is not present in the other. In this paper we represent a new hybrid image reconstruction method based on the linear sampling method by combining two perpendicular polarizations. The result shows higher quality in the reconstruction of the target shape for both penetrable and impenetrable targets. Implementation of the hybrid method requires changes in the far-field equation which will be explained in the presentation.

On the other hand the most interesting factor in image reconstruction process using LSM technique is the speed. Generally qualitative methods such LSM are faster than quantitative ones; however, lower image resolution is the cost of this superiority. In the proposed hybrid method the speed of sampling by the LSM is decreased compared to the normal LSM based on TE or TM polarization. But it leads to better reconstruction resolution according to simulations. Some other factors like frequency and the nature of the incident field has been discussed which comes back to the EFIE or MFIE in method of moment used in forward scattering.