

## **Hard Wall Imaging of Objects hidden by non-penetrating obstacles using Time Reversal technique**

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One of the important current problems is imaging and detection of objects hidden by obscuring non-penetrating obstacles. There have been extensive research on “through wall imaging”, but our interest is focused on imaging objects which are obscured by non-penetrating obstacles such as “hard wall”. The hard wall imaging may have potential applications in many problems of practical interest such as objects behind hard walls near terrain.

The “hard wall imaging” is related to historical problem of diffraction behind a disk, known as “Poisson Spot” and the increase of radio signal at the “anti-podal point” of the spherical earth. Our study is based on time –reversal technique including GTD (geometrical theory of diffraction). It is known that time reversal DORT (Decomposition of Time Reversal Operator) imaging shows that the iterative time reversal process is equivalent to finding the eigenvectors of Time Reversal matrix, which is obtained from the multi-static data matrix. And the eigenvector of the largest eigenvalues focuses on a target. We can then combine this with steering vector to form the imaging function. It is also important to include the time dependence and wide band.

As a numerical example, we show a hard wall placed between the sensors and the target. The initial result shows two images close to the target. There are several points under additional considerations. Lateral and range resolutions will be considered. GTD we used for our initial study is deterministic GTD. Further study is under way to include stochastic GTD, which should show sensitivities on resolutions and the effects of intervening random media.