

A Faster and Non-singular Algorithm Based on MoM and Its Applications on Calculating PEC Target's Scatter Field

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The method of moments is often used to calculate the scattering characteristics of targets and has important applications in many fields. The traditional moment method takes a lot of time to calculate the impedance matrix elements, and it is difficult to avoid the problem of singular integration, which affects the efficiency. In this paper, a non-singular fast algorithm for perfect electric conductor(PEC) targets is proposed, which eliminates the singularity by changing the position of the integral point, reduces the computation of the filling impedance matrix, and greatly increases the overall efficiency under the premise of ensuring the accuracy. This method has a new enlightenment on the improvement of the method of moments(MoM).

In this paper, we utilized the property of zero electric field inside the PEC conductor, no longer use the traditional boundary integral equation of MoM, but transfer the reference point to the target interior, and get a new impedance matrix. In the process of solving the matrix, since the integral singularity is removed, the condition number of the matrix is correspondingly increased. For this problem, we put forward a very effective regularization method by using the surface continuity of the current, so that the ill-posed problem can be solved. In addition, this method can improve accuracy by solving an overdetermined matrix, the number of calculation points can exceed the number of mesh elements, and the accuracy can be further improved by adding additional calculation points.

Our method has achieved remarkable results in the calculation of PEC targets. The addition of regularization makes the correct results can be obtained in large curvature regions such as wedges or vertexes. FIG. 1 shows an example of PEC cone, the incident wave is a plane wave incident in the positive direction of x axis. The time consuming ratio in (c) equals the ratio of simulation time consumption of MoM to the time consumption of the proposed method. We can see a considerable improvement of simulation efficiency, and the accuracy has also been guaranteed.

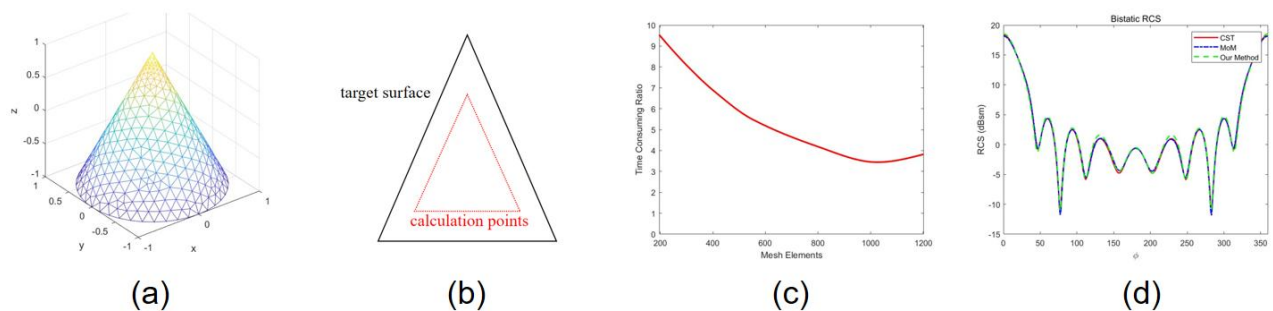


Figure 1. (a): Simulation target and its triangle mesh (b): Calculation points in proposed method (c): Time consuming ratio (d): Simulation result of three different methods