

Modified Phillips-Tikhonov regularization for plasma image reconstruction with modified Laplacian matrix

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The tomography has played a key role in tokamak plasma diagnostics for image reconstruction. The Phillips-Tikhonov (P-T) regularization method was attempted in this work to reconstruct cross-sectional phantom images of the plasma by minimizing the gradient between adjacent pixel data. Recent studies about the comparison of the several tomographic reconstruction methods showed that the P-T method produced more accurate results.

We have studied existing Laplacian matrix used in Phillips-Tikhonov regularization method and developed modified Laplacian matrix (Modified L). The comparison of the reconstruction result by the modified L and existing L showed that modified L produced more accurate result. The difference was significantly pronounced when a portion of plasma was reconstructed. These results can be utilized in the Edge Plasma diagnostics; especially in divertor diagnostics on tokamak a large impact is expected. In addition, accurate reconstruction results from received data in only one direction were confirmed through phantom test by using P-T method with modified L. These results can be applied to the tangentially viewing pin-hole camera diagnostics on tokamak.