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4.29 Comparative study of L1 & L2 type Phillip-Tikhonov regularization based tomographic reconstruction for simulated Heliotron−J Soft X-ray measurements

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Tomographic reconstructions of line integrated SX plasma measurements are an ill-conditioned problem, therefore, resorts to regularization. Regularization overcome ill-conditions and over-fitting issues by introduction of controlled penalty function (PF). L1 regularization PF considers absolute weights of parameters and shrinks less important weights to zero or very less. This results in a smooth but sparse image. L2 regularization PF involves squared weights of parameters and penalized large weights while retaining total number of parameters, which offers spars-less, very smooth image. L2 regularization exhibit invariant to rotation and scale, unique solution and efficient computation, whereas superior smoothness purges sharp transitions and trims edge futures visibility. Results from a comparative study of L1 & L2 Phillip-Tikhonov regularization based tomographic reconstructions of simulated Heliotron-J SX signals are presented. Line integrated SX data is estimated from flux surface information provided by VEMC code and contribution matrix for the viewing geometry is determined. Generalized cross validation method is employed for regularization parameter. Reconstruction is performed by minimization of least mean square error function under L1 & L2 penalty function.

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