

Positive Definite Quasi Linear Operator Formulation*

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Expressions for the RF quasi-linear operator are biquadratic sums over the Fourier modes (or FLR equivalent) that describe the RF electric field with a kernel that is a function of the two wave vectors, \mathbf{k} and \mathbf{k}' , in the sum[1]. As a result of either an implicit or explicit average over field lines or flux surfaces, this kernel only depends on one parallel wave vector, conventionally k_{\parallel} . When \mathbf{E} is an independent component of the representation for \mathbf{E} , the sums are demonstrably positive definite. However, except for the case with no poloidal field, k_{\parallel} is dependent on the local direction of the equilibrium magnetic field, and, empirically, the absorbed energy and quasi-linear diffusion coefficients are observed to have negative features. We have formally introduced an independent k_{\parallel} sum by Fourier transforming the RF electric field, (assuming straight field lines) using a field-line-length coordinate. The resulting expression is positive definite. We have modeled this approach by calculating the quasi linear operator for “modes” with fixed k_{\parallel} . We form these modes by discretizing k_{\parallel} and then assigning all of the Fourier components with k_{\parallel} that fall within a given bin to that mode. Results will be shown as a function of the number of bins. Future work will involve implementing the expressions derived from the Fourier transform and evaluating the dependence on field line length.

1. D. N. Smithe, Plasma Phys. Controlled Fusion **31**, 1105 (1989) and references therein.

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