Generalized Force Approach to Point-to-Point Ray Tracing in Reconstructed Ionosphere by Radio Tomography Data

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A variant of the direct optimization method for solving the point-to-point ionospheric ray tracing problem is presented. Within the method, a candidate ray path is iteratively transformed to an optimal configuration satisfying the Fermat's principle [1], while the boundary conditions are met automatically by fixing the endpoints at the desired positions. The ray search is guided by a generalized force, where the definition of the force depends on the type of the ray [2]. Definite knowledge about the character of the rays makes it possible to establish an efficient global ray tracing procedure where all relevant rays between the fixed points are found one after another in a systematic manner, without a need to provide an accurate initial estimate for each solution. Application of the approach to a radio tomography data are presented to illustrate its ability to resolve complex ray configurations and multi-path propagation where rays are close in the launch direction. Simulation of the transionospheric ray paths between low-orbit satellite and ground-based receiver to is also considered taking into account ionospheric disturbances.

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References

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