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3-D Vector Tomography Diagnostics for Spherical Tokamacs

ALEXANDER BALANDIN, Institute of System Dynamics and Control Theory of Russian Academy of Sciences, YASUSHI ONO, Tokyo University — Plasma emits radiation over a broad frequency range. Characteristics of the radiation are related to plasma parameters then may be applied for diagnostics. These methods are quite attractive since they do not introduce any perturbation in to plasma. In a such complex objects as plasma, the spectroscopic measurements, for example, can contain information concerning the distribution of both parameters of scalar and vector (velocity) fields. In this report, the numerical method is proposed for the inversion of the vector X-ray transform of 3-D vector fields, which is based on series expansion method. We first of all discuss the Central Slice Theorem for the vector X-ray transform and, as the corollary it is obtained that the irrotational component of the vector field gives no contribution to the path-integral, leaving only the contribution from the solenoidal part. The tomographic reconstruction of 3-D vector fields is performed by the two different methods: expansion of components of the vector field into the orthogonal system of scalar spherical harmonics and in the second one is used the decomposition over the orthogonal system of vector spherical harmonics. The first method can be used for the reconstruction of both vector field parameters and scalar ones by solving large system of linear equations with respect to expansion coefficients. The second one are applied for reconstruction only vector fields. The computer simulation, demonstrating the 3-D reconstruction of the model vector fields is presented.

Yasushi Ono
Tokyo University

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