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Fast Boundary Reconstruction from Tangentially Viewed Visible Images for Plasma Control in EAST

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The fast plasma boundary reconstruction is usually used for real-time control of tokamak plasma. In EAST experiment, the time consuming for boundary reconstruction should be within 1ms to meet the need of real-time control. A fast algorithm based on visible imaging diagnostics is developed in EAST to reconstruct the plasma boundary directly and independently. Compared to the results of EFIT, the overall average error is within 1.5cm, the average error at the lower X point is within 1cm, and the average error at the outermost and innermost points of LCFS are below 0.5cm. The causes of the deviation are discussed, and the methods for decrease are presented. For an image with the size of 680×544, the algorithm implemented by C++ with OpenCV can complete the computation in 0.9ms , achieving an acceleration of 300 times, when compared with parallel MATLAB. Furthermore, when the pixels of camera sensor is not saturated, the algorithm is robust for different intensities of the discharge images.

Keywords: Plasma boundary reconstruction; Visible imaging diagnostics; EAST; OpenCV; Plasma control

Eligible for student paper award?

Yes

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