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Plasma Boundary Shape Reconstruction Using Visible Spectroscopy Diagnosis on EAST Tokamak

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Plasma shape control is a prerequisite for the stable operation of tokamak devices. Future fusion reactors anticipated to have longer burn length and higher discharge performance, current shape reconstruction methods based on magnetic diagnostics will encounter challenges related to signal drift and probe maintenance. Hence, a plasma boundary shape reconstruction system utilizing visible spectrum images was introduced and deployed on the EAST tokamak. The optics and high-speed camera system installed in the J port of the EAST tokamak were employed to capture high-speed real-time images of plasma discharge. An algorithm for boundary extraction relying on grayscale features, a camera calibration algorithm employing feature point matching, and a coordinate mapping algorithm utilizing plasma geometric features were developed. These algorithms collectively enable plasma boundary shape reconstruction via visible spectrum diagnostics. Utilizing the visible spectrum diagnostic hardware system and software algorithm mentioned above, the plasma shape during the discharge process was reconstructed in real time, and the curve of the control point position changing with time was obtained. The reconstruction results were verified in EAST control experiments. This work validates the feasibility of reconstructing plasma shape on an ITER-like tokamak device using visible spectrum diagnosis. This method can serve as a supplementary tool for magnetic measurements to enhance the accuracy of shape reconstruction or offer a potential alternative for plasma shape reconstruction.

References:
[1] Kocan, M., et al. “Steady state magnetic sensors for ITER and beyond: Development and final design.” Review of Scientific Instruments 89.10 (2018).
[2] Hommen, G., et al. (2014). “Real-time optical plasma boundary reconstruction for plasma position control at the TCV Tokamak.” Nuclear Fusion 54(7).
[3] Han, X., et al. (2023). “Development of multi-band and high-speed visible endoscope diagnostic on EAST with catadioptric optics.” Plasma Science and Technology 25(5): 055602.
[4] Ming, C., et al. (2024). “Development of Dα band symmetrical visible optical diagnostic for boundary reconstruction on EAST tokamak. “ Plasma Science and Technology, 26(2), 025104.

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