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Development of Data Assimilation System for Control of Toroidal Plasmas

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ASTI, a data assimilation system for integrated simulation of fusion plasma, is being developed to analyze, predict, and control the fusion plasma behavior. ASTI employs the ensemble Kalman filter (EnKF) and smoother (EnKS) as data assimilation methods. The integrated transport simulation code for helical fusion plasmas, TASK3D, is employed as the system model in the data assimilation framework. In this study, a control method for fusion toroidal plasmas using data assimilation techniques has been developed and implemented in ASTI. The heating input parameters are estimated sequentially by assimilating the target states of plasma into the integrated simulation. Furthermore, the simulation model parameters with uncertainties are optimized to enhance simulation accuracy by sequentially assimilating the observation results. The implemented control method keeps the prediction performance of the employed simulation model and adjusts the heating input parameters to achieve the target state. To investigate the effectiveness of the control method, ASTI is applied to control the simulated LHD plasma by the integrated simulation code, TASK3D, assuming the appropriate transport models.

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