

Safety factor profile control with reduced CS flux consumption during plasma current ramp-up phase using reinforcement learning technique

Wednesday, 24 October 2018 08:30 (4 hours)

Safety factor profile control via active feedback control of electron temperature profile during a plasma current ramp-up phase of a DEMO reactor is investigated to minimize the magnetic flux consumption of a central solenoid (CS) for wide range of q profiles. It is shown that q profiles with positive, weak and reversed magnetic shear can be obtained with less than half of the empirical estimation of the resistive flux consumption (Ψ_{res}). For the optimization of time dependent feedback gain, we introduced a reinforcement learning technique. This enables to follow a rapid change in the target profile of the electron temperature by changing the feedback gain adaptively. With this adaptive feature of the reinforcement learning, we also confirmed that T_e profile can be controlled in the plasma simulation with various thermal transport property by one control system.

Country or International Organization

Japan

Paper Number

EX/P3-25

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Session Classification: P3 Posters