

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

Wednesday, October 24, 2018 8:30 AM (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 ( $\Psi_{\text{res}}$ ). 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