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Plasma Control Studies Using DIII-D Design Tools in Support of ITER

Thursday, 20 October 2016 14:00 (4h 45m)

Control analysis and design tools developed at DIII-D [1] have been applied to ITER in studies supporting design of the ITER Plasma Control System (PCS) [2] to prepare for the upcoming PCS Preliminary Design Review (PDR). These studies include assessment of an extremum-seeking approach to real-time error field correction, advances in vertical controllability metrics, simulation of plasma initiation, evaluation of real-time equilibrium reconstruction effectiveness, and development of an integrated algorithmic approach to exception handling toward disruption-free operation of ITER. Integrated simulations have demonstrated the robustness and mutual compatibility of key control algorithms, as well as the effectiveness of critical exception handling algorithms in limiting the disruption frequency in ITER. The present studies follow the ITER PCS Preliminary Design focus on control requirements for the First Plasma and Early Non-neutronic (H/He species) operating phases of ITER. Operating regimes are analyzed with plasma current ranging from several hundred kA to 15 MA and either full (5.3 T) or half (2.65 T) toroidal field, with corresponding machine operating limits and exception thresholds. These studies confirm the existence and consistency of control solutions with both device resources and PCS architecture.

[1] Humphreys, D.A., et al, Nucl. Fusion 47 (2007) 943
[2] Snipes, J.A., et al, Fus. Eng. and Design 89 (2014) 507

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