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Plasma flux expansion control for heat flux regulation on the DIII-D tokamak HIMANK ANAND, DAVID HUMPHREYS, DAVID ELDON, ANTHONY LEONARD, ALAN HYATT, BRIAN SAMMULI, ANDERS WELANDER, DIII-D National Fusion Facility, General Atomics, PO Box 85608, San Diego,CA 92186, USA — Future reactors, including ITER, will have to withstand severe steady state high heat flux loads on many plasma-facing components (PFCs). Thus, robust, reliable and simplified physics-based RT models for monitoring and effective feedback control strategies for PFC heat load control are mandatory on future fusion reactors. Flux expansion control in the scrape-off layer of a reactor offers the possibility of controlling heat flux and divertor detachment closer to the timescale of the ion equilibration time (˜few to 10's of ms) in comparison to the slow response (˜1 s) anticipated for reactor gas valves. A new controller has been developed to make use of the flexible divertor poloidal field coil set of the DIII-D tokamak, and enable precise control of the flux expansion. The design ensures flexibility through a complementary set of orthogonal actuator directions to guarantee minimum effect on existing controlled variables, e.g. radial and vertical position of the X-point. A non-linear free-boundary simulation code (GSevolve) is used to study the closed loop response and to verify the implementation of the algorithm on the DIII-D plasma control system. First results of the experimental commissioning of the new controller during the 2020 DIII-D campaign are presented

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