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Progress on Schwarz-type coupling of core- and edge-region tokamak simulations for whole device modeling LEE RICKETSON, Lawrence Livermore Natl Lab, AMMAR HAKIM, Princeton Plasma Physics Lab, JEFFREY HITTINGER, Lawrence Livermore Natl Lab — The edge and core regions of a tokamak differ drastically on many fronts – geometry and collisionality, to name only two among many. It is thus natural that different numerical methods are optimally suited to the simulation of each region. However, this creates a challenge for the pursuit of whole device modeling (WDM): How can one self-consistently couple two distinct codes to achieve a uniformly accurate description of the entire tokamak? In support of the ECP goal of coupling the codes GENE (core) and XGC (edge) for whole device modeling, we present such a coupling scheme inspired by classical additive Schwarz methods. While traditional Schwarz schemes require iteration to convergence inside a single time step, this is computationally intractable in the context of 5-D gyrokinetic simulations. We give evidence – both analytic and empirical – that if one is interested only in long-time (e.g. transport-scale) averages, then this expensive iteration can be avoided while retaining the scheme's convergence properties. We present numerical results from tests on both a 1-D model problem and 2-D simulations of the Hasegawa-Wakatani equations. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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