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Finite-Element Solution of a Vorticity Transport Model Including RF Antenna Effects and Application to Scrape-Off-Layer-Turbulence Simulations[1] A.M. DIMITS, M. HOLEC, I. JOSEPH, T. ROGNLIEN, C.J. VOGEL, M.V. UMANSKY, LLNL, J. MYRA, Lodestar Corp., D. SMITHE, Tech-X Corp. — Radio-frequency (RF) heating and current drive are important for magnetic fusion devices. The associated antenna structures can result in large rectified sheath potentials and ponderomotive forces, which can drive large plasma flows. These can drive or suppress turbulence in the scrape-off layer (SOL), which can significantly affect the RF-wave coupling to and propagation in the plasma. To model the plasma flows with the complicated (material) boundary shapes and boundary conditions needed, a drift-reduced fluid model has been implemented in the COMSOL Multiphysics finite-element (FEM) package, and is also being implemented in the more scalable Modular Finite-EleMent (MFEM) package. Steady-state solutions have been obtained with model RF-antenna-structure boundaries, RF-sheath boundary conditions and ponderomotive force contributions, so far in a simplified two-dimensional, axisymmetric geometry. From these solutions are generated boundary conditions on a flux surface, which can then be used in BOUT++-based turbulence codes such as SOLT3D. The FEM-based implementations are being generalized to find steady solutions with complicated three-dimensional domains, boundaries, and ponderomotive sources.

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