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Synthetic Microwave Imaging Reflectometry diagnostic using 3D FDTD Simulations[1] SCOTT KRUGER, THOMAS JENKINS, DAVID SMITHE, JACOB KING, Tech-X Corporation, NIMROD TEAM TEAM — Microwave Imaging Reflectometry (MIR) has become a standard diagnostic [X Ren et al. Rev Sci Instrum 83 (10), 10E338 2012] for understanding tokamak edge perturbations, including the edge harmonic oscillations in QH mode operation [Garafalo et al., Phys. Plasmas 22, 056116 (2015)]. These long-wavelength perturbations are larger than the normal turbulent fluctuation levels and thus normal analysis of synthetic signals become more difficult. To investigate, we construct a synthetic MIR diagnostic for exploring density fluctuation amplitudes in the tokamak plasma edge by using the three-dimensional, full-wave FDTD code Vorpal. The source microwave beam for the diagnostic is generated and refelected at the cutoff surface that is distorted by 2D density fluctuations in the edge plasma. Synthetic imaging optics at the detector can be used to understand the fluctuation and background density profiles. We apply the diagnostic to understand the fluctuations in edge plasma density during QH-mode activity in the DIII-D tokamak, as modeled by the NIMROD code [King et.al, Phys. Plasmas and Nucl. Fus. 2017].

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