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Benchmarking of the Gyrokinetic Microstability Codes GYRO, GS2, and GEM[1] RONALD BRAVENEC, Fourth State Research, YANG CHEN, WEIGANG WAN, SCOTT PARKER, University of Colorado, Boulder, JEFF CANDY, General Atomics, MICHAEL BARNES, NATHAN HOWARD, MIT, CHRISTOPHER HOLLAND, University of California, San Diego, ERIC WANG, LLNL — The physics capabilities of modern gyrokinetic microstability codes are now so extensive that they cannot be verified fully for realistic tokamak plasmas using purely analytic approaches. Instead, verification (demonstrating that the codes correctly solve the gyrokinetic-Maxwell equations) must rely on benchmarking (comparing code results for identical plasmas and physics). Benchmarking exercises for a low-power DIII-D discharge at the mid-radius have been presented recently for the Eulerian codes GYRO and GS2 [R.V. Bravenec, J. Candy, M. Barnes, C. Holland, Phys. Plasmas **18**, 122505 (2011)]. This work omitted $\mathbf{E}\times\mathbf{B}$ flow shear, but we include it here. We also present GYRO/GS2 comparisons for a high-power Alcator C-Mod discharge. To add further confidence to the verification exercises, we have recently added the particle-in-cell (PIC) code GEM to the efforts. We find good agreement of linear frequencies between GEM and GYRO/GS2 for the DIII-D plasma. We also present preliminary nonlinear comparisons. This benchmarking includes electromagnetic effects, plasma shaping, kinetic electrons and one impurity. In addition, we compare linear results among the three codes for the steep-gradient edge region of a DIII-D plasma between edge-localized modes.

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