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Implementation of Large Scale $E \times B$ Shear Flow in the GS2 Gyrokinetic Turbulence Code[1] G.W. HAMMETT, Princeton Plasma Physics Lab, W. DORLAND, N.F. LOUREIRO, T. TATSUNO, Univ. Maryland — GS2 is a 5-D gyrokinetic flux-tube code for studying turbulence in general geometry plasmas. It has always self-consistently included small-scale zonal flows (with radial wavelengths smaller than the simulation domain) that are driven by the turbulence, but for simplicity it neglected equilibrium-scale zonal flows (which are not radially periodic on the simulation scale) that can be driven by beam injection, neoclassical effects, etc. Shearing rate estimates of corrections due to equilibrium-scale flows could be made based on earlier gyrofluid and gyrokinetic nonlinear simulations by Waltz et al. and Dimits et al. Large-scale sheared flows can be implemented directly in a flux-tube code by transforming to moving coordinates where the physical radial wavenumber k_x is related to the radial wavenumber k'_x in shearing coordinates by $k_x(t) = k'_x - k'_y \gamma_{E\times B} t$, where $\gamma_{E\times B}$ is the shearing rate. Direct implementation of this is challenging in GS2's implicit algorithm, as that would require a large overhead of recalculating the implicit response matrices every time step. By discretizing the effective k_x, we can avoid this large overhead, and yet still be effectively 2cd order accurate (similar to how Godunov splitting is effectively 2cd order accurate) and it converges well for typical parameters. Examples and tests of the GS2 implementation will be presented.

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