Status of the COGENT Edge Kinetic Code[1]

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COGENT is a continuum gyrokinetic code being developed by the Edge Simulation Laboratory for edge plasmas. The code is distinguished by application of 4th order conservative discretization, and mapped multiblock grid technology to handle the geometric complexity of the tokamak edge. It is written in $v_\parallel, \mu$ velocity coordinates. Our recent development work has focussed on the incorporation of colllision operators, adding a radial diffusion operator to qualitatively simulate the effects of turbulent transport, and upgrading to include divertor geometry (*i.e.*, on where there is a magnetic separatrix). We have added a succession of increasingly detailed collision operator options, including a simple drag-diffusion operator in $v_\parallel$, Krook collisions, Lorentz collisions, and a linearized model Fokker-Planck collision operator conserving momentum and energy. Based on the generalization of the linearized operator we have also formulated a model nonlinear collision operator for the case where a distribution function is nearly isotropic, but arbitrary in speed. We have performed a number of verification tests of these operators, including recovery of analytic results for loss over a prescribed potential barrier and neoclassical fluxes. Work in progress includes testing of the neoclassical simulations with a self-consistent potential and recovering the effects of a large radial electric field on the neoclassical flow velocities.

We are concurrently making rapid progress toward development of a divertor version of the code. The key piece of new technology we exploit, recently released in our underlying CHOMBO framework, is a mapped multiblock capability, whereby the closed-flux-surface edge, scrape-off-layer, and private-flux regions of a tokamak are described by separate blocks of grids which communicate through their common boundaries. We are mostly completed with the process of implementing this technology in COGENT, revamping data structures and generalizing interfaces as needed. We have also been developing the software necessary to provide the needed metric coefficients for numerically prescribed divertor configurations and extending the geometry classes as needed to handle the increased geometric complexity; this included developing interpolation and smoothing algorithms that correctly capture the effects of the separatrix X point to the requisite (4th) order.

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