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Variational Symplectic Orbit Code in 3-D Tokamak Geometry¹ CHARLES ELLISON, HONG QIN, WILLIAM M. TANG, Princeton Plasma Physics Laboratory — Since advanced tokamak experiments – including ITER – are long-pulse systems, it is important to develop accurate numerical methods to track plasma dynamics over an extended temporal period. When attempting to model the motion of individual particles, standard integrators (e.g. 4th order Runge-Kutta) discretize the differential equations of motion – but do not possess desired properties such as energy conservation. The variational symplectic integrator adopts instead a different approach via minimizing the action of the guiding center motion to determine iteration rules. Consequently, the Lagrangian symplectic structure is conserved, and the numerical energy error is bounded by a small number for all timesteps. In previous work [1], the theoretical basis for this method was introduced, but the implementation was for 2-D geometry. To address realistic experimental scenarios, the variational symplectic integrator has been implemented for 3-D tokamak geometry for the first time. Sample results will be presented and compared with those from standard Runge-Kutta-based 3-D tokamak orbit codes.

[1] H. Qin, X. Guan, and W. M. Tang, PHYSICS OF PLASMAS 16, 042510 2009.

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